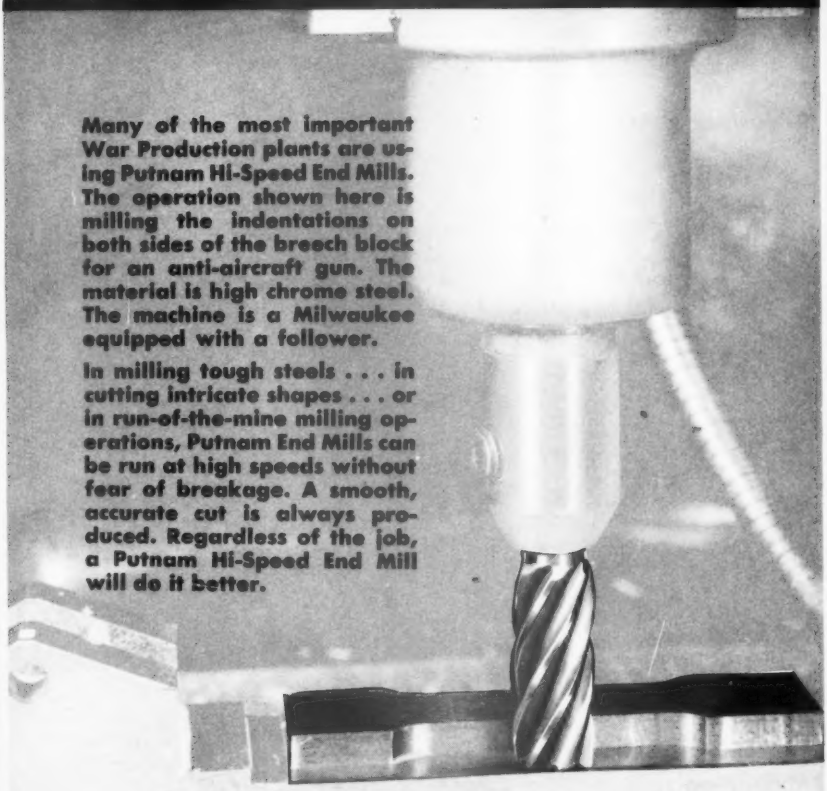
The TOOL & DIE Journal
Tool-Die-Machine PROGRESS

ANOTHER PUTNAM END MILL
Speeding War Production



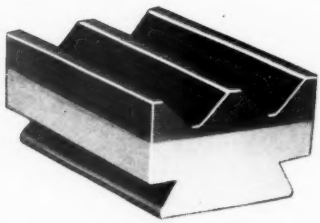
Many of the most important War Production plants are using Putnam Hi-Speed End Mills. The operation shown here is milling the indentations on both sides of the breech block for an anti-aircraft gun. The material is high chrome steel. The machine is a Milwaukee equipped with a follower.

In milling tough steels . . . in cutting intricate shapes . . . or in run-of-the-mine milling operations, Putnam End Mills can be run at high speeds without fear of breakage. A smooth, accurate cut is always produced. Regardless of the job, a Putnam Hi-Speed End Mill will do it better.

PUTNAM *Hi-Speed* END MILLS

PUTNAM TOOL CO. • 2985 Charlevoix Ave. • Detroit

NEW WAY TO CONSERVE HIGH SPEED STEEL



Dovetail forming cutters made from FCC Electrically Welded Composite Steel Blanks *(high speed steel cutting face; mild steel base)* **save at least 50% of high speed steel. Besides, they offer other distinct advantages. Obvious among them are:—**

1. **Non-hardenable, tough base minimizes tendency to crack and break out at sharp dovetail corners and screw holes during heat treating or when working.**

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4. **Inseparable bond between cutting face and base assured by special technique of electric welding.**

5. ***Marked saving of strategically important tungsten.***

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Fast, accurate, dependable . . .

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SPECIFICATIONS

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8 Speeds: 110 to 1850 R P M
Cutter and Index Head have 1" Collet Capacity

"Performance has established leadership for HARDINGE"

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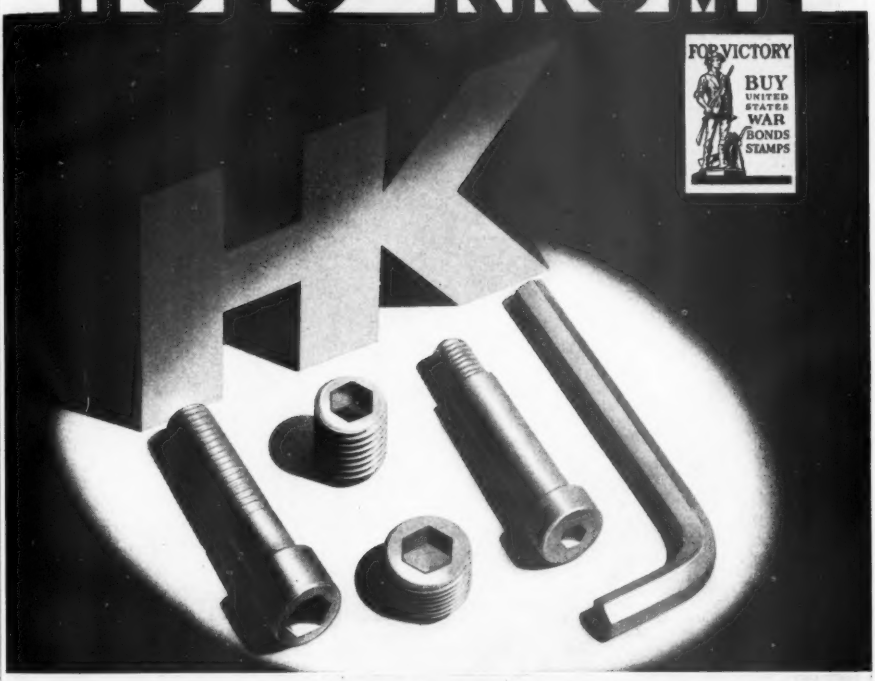

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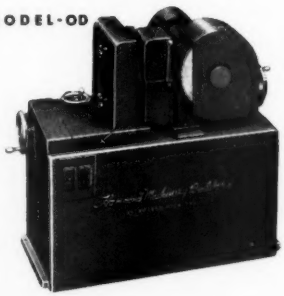

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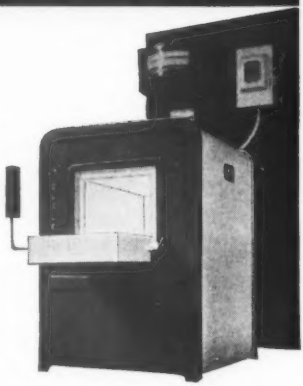

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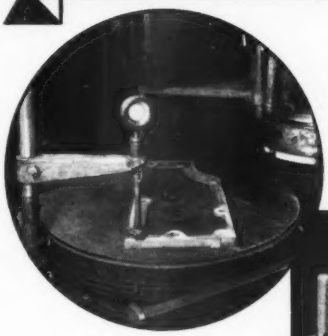
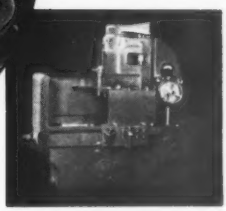
"Ground from the Solid after Hardening"

"PUT IT ON THE BLANCHARD"



Cast Iron, 30½" x 13" x 1"
Stock per side 1/16"
Limits — must be parallel
Number of Sides 2
2 pieces (4 surfaces) per hr.



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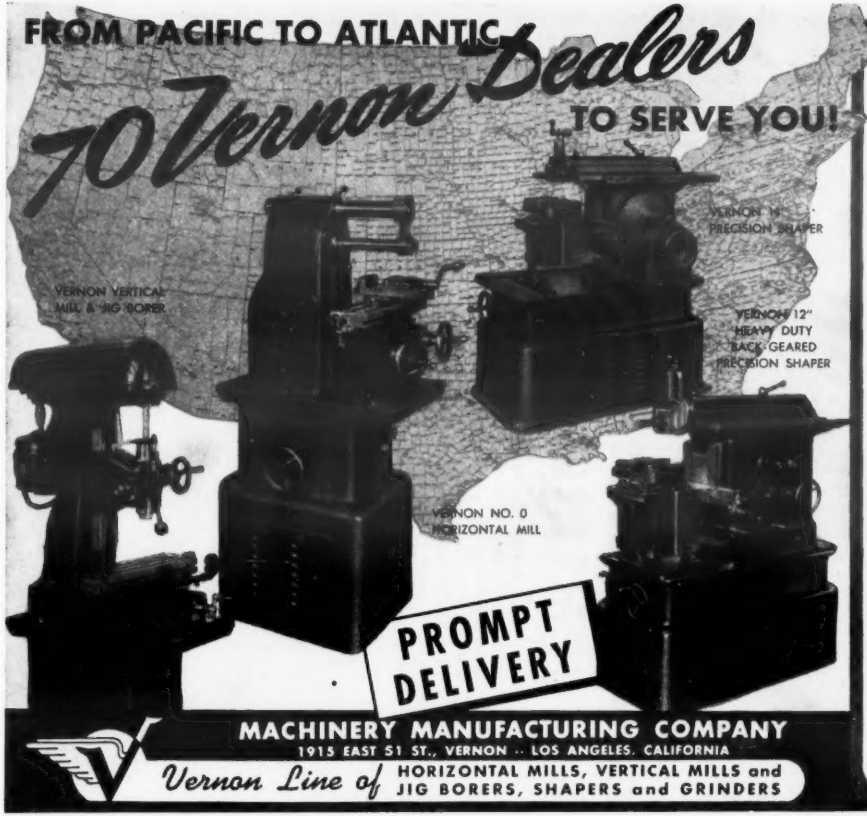
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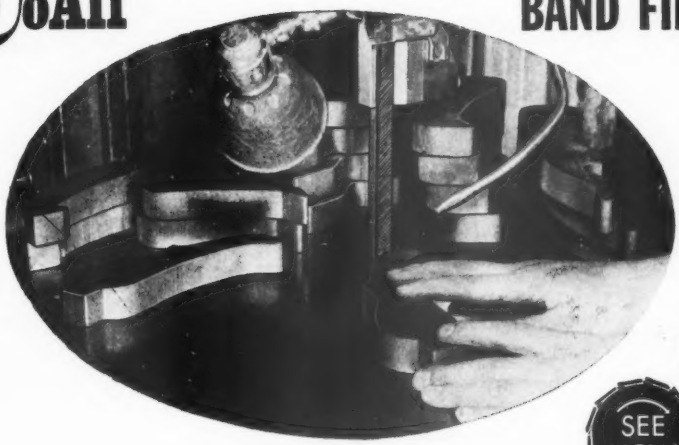

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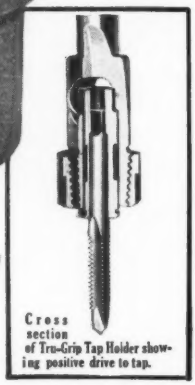

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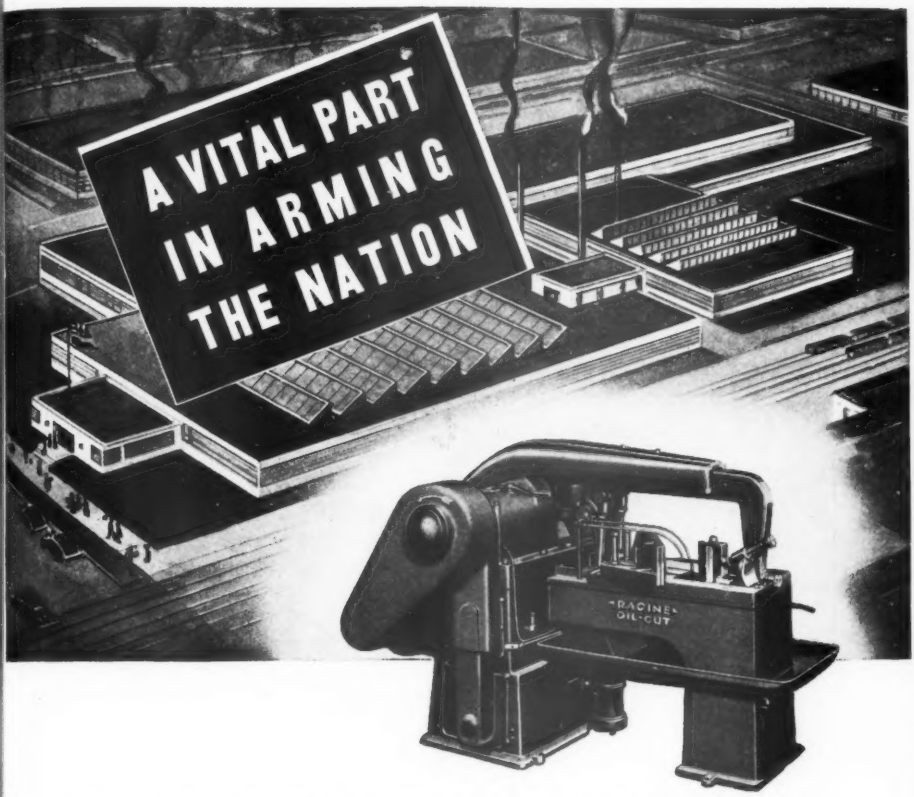

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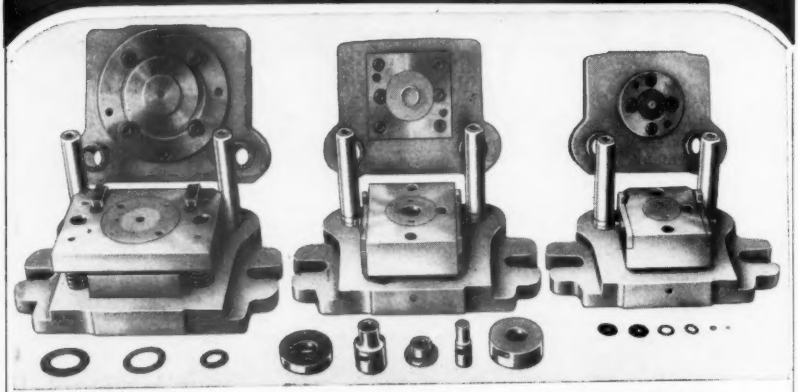

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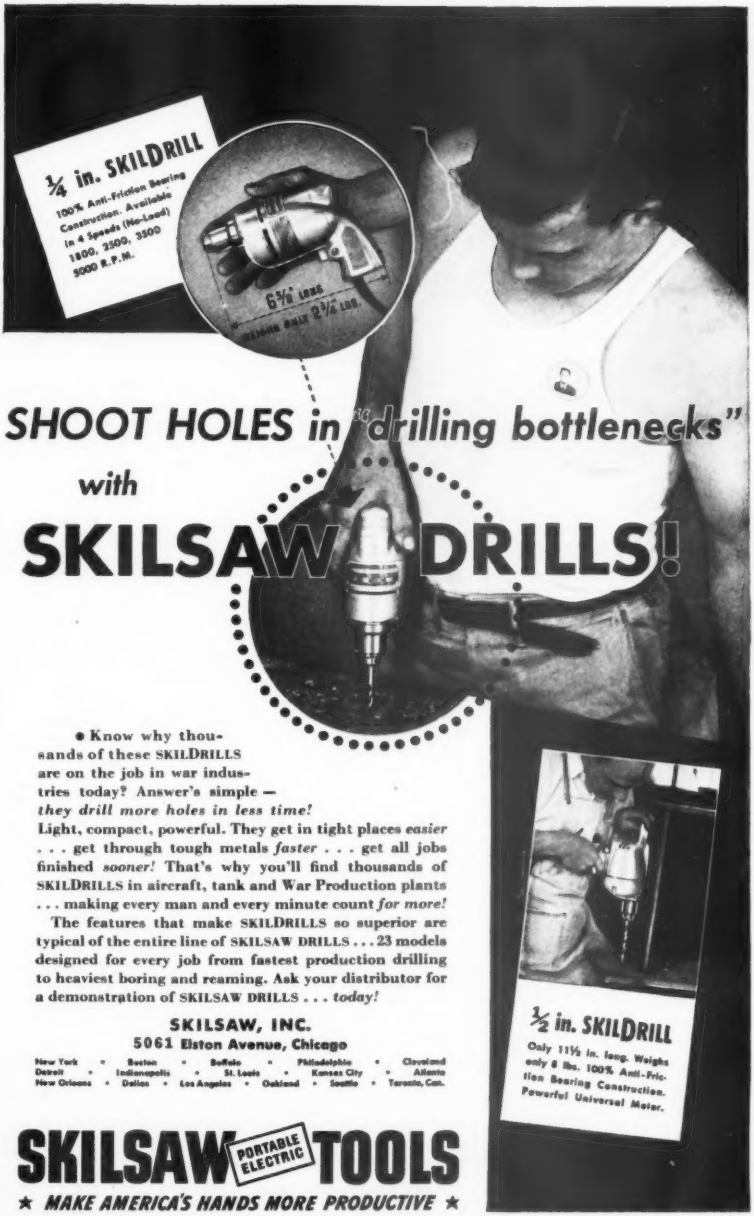
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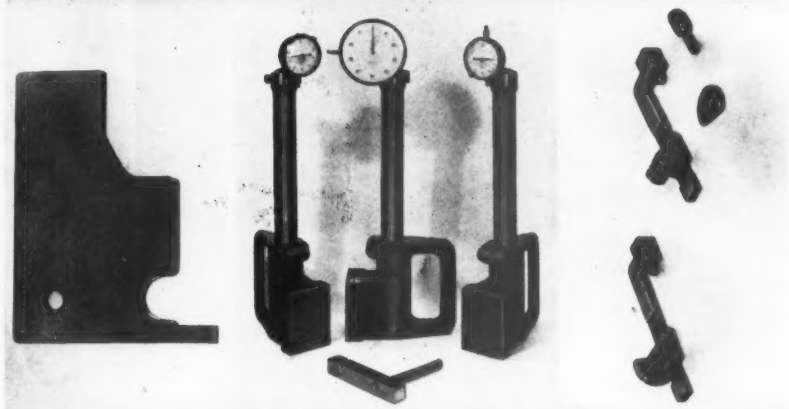

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● Multiple operations on large runs of duplicate parts can be handled quickly and accurately on Gorton Pantograph Engravers. On this job the manufacturer uses Gorton Single Flute High-Speed Cutters operating at 9,200 r.p.m., and maintains an accuracy of ±.0015″ while profiling. The remainder of the operations are performed with a ¼″ diameter straight shank cutter running at comparable speeds.

The brass index plates made from $\frac{3}{16}$″ strip material come to the Gorton Pantograph Engraver with three drilled and countersunk holes. The operations performed are shown on the front and back views of the completed plate.

In addition to work of this nature, the Pantograph Engraver may be used for engraving dies, molds, dials, flat and curved work, and other general engraving, profiling and lettering work.

PANTOGRAPH DATA

MACHINE—Gorton 3-Z Pantograph Engraver.
PART—Index Plate.
MATERIAL—3/16″ Engraver's Brass.
QUANTITY—300 Pieces.
CUTTER—¼″ dia. Straight Shank Single Flute End Mills.
OPERATION—Engraving, Marking and Profiling complete from solid strip.
HOLDING—Special Jig with "T" Slot Clamp.
FEED—Manual.
SPEED—Top Speed—9200 r.p.m.
TIME—1½ Hours Complete.
ACCURACY—±.0015″.

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covering Gorton Pantograph Engraving Machines and Attachments. Also covers other Gorton engraving machines for special purposes.

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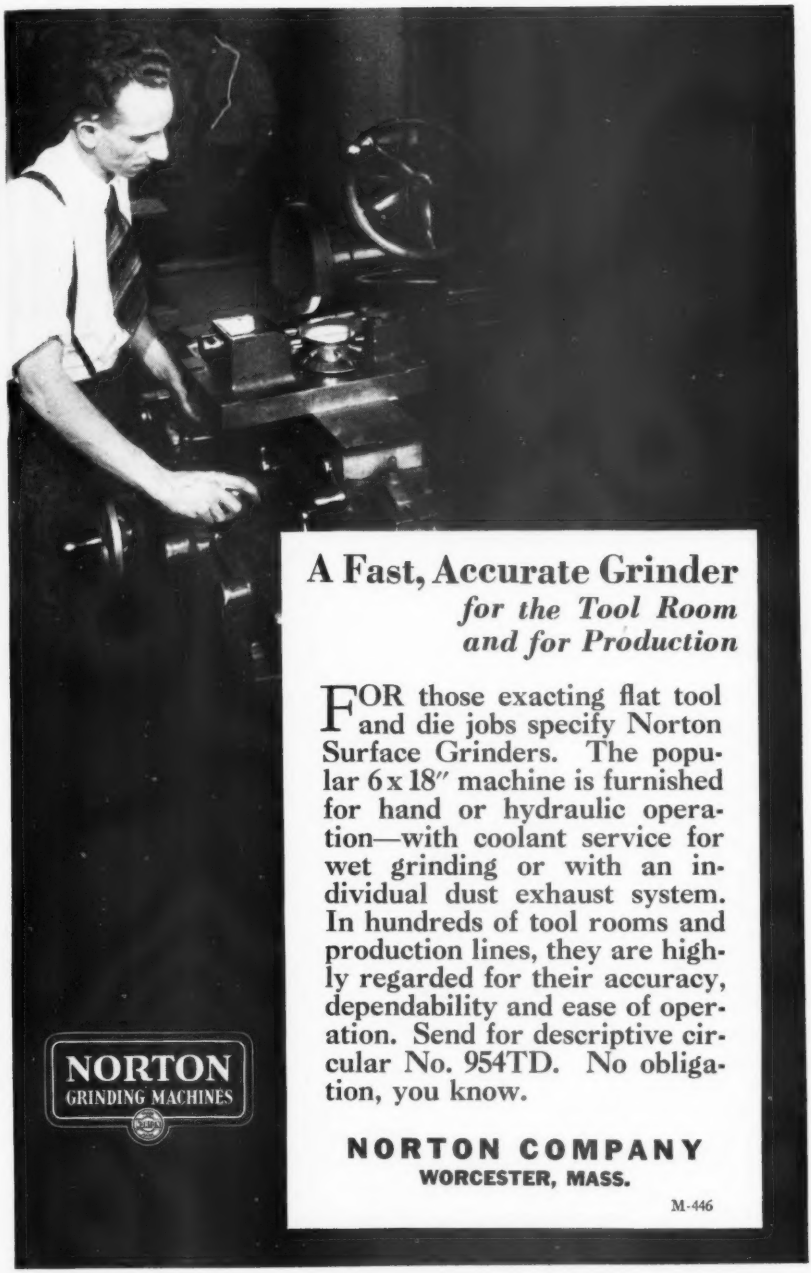

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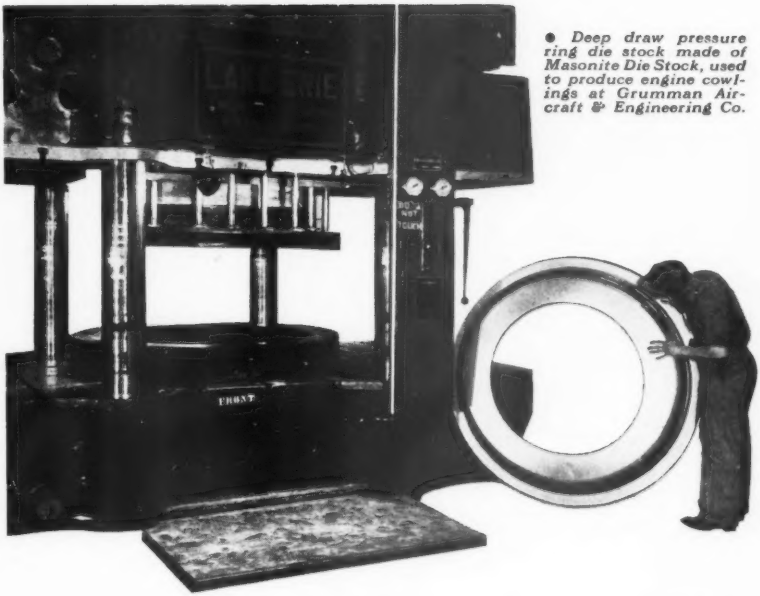

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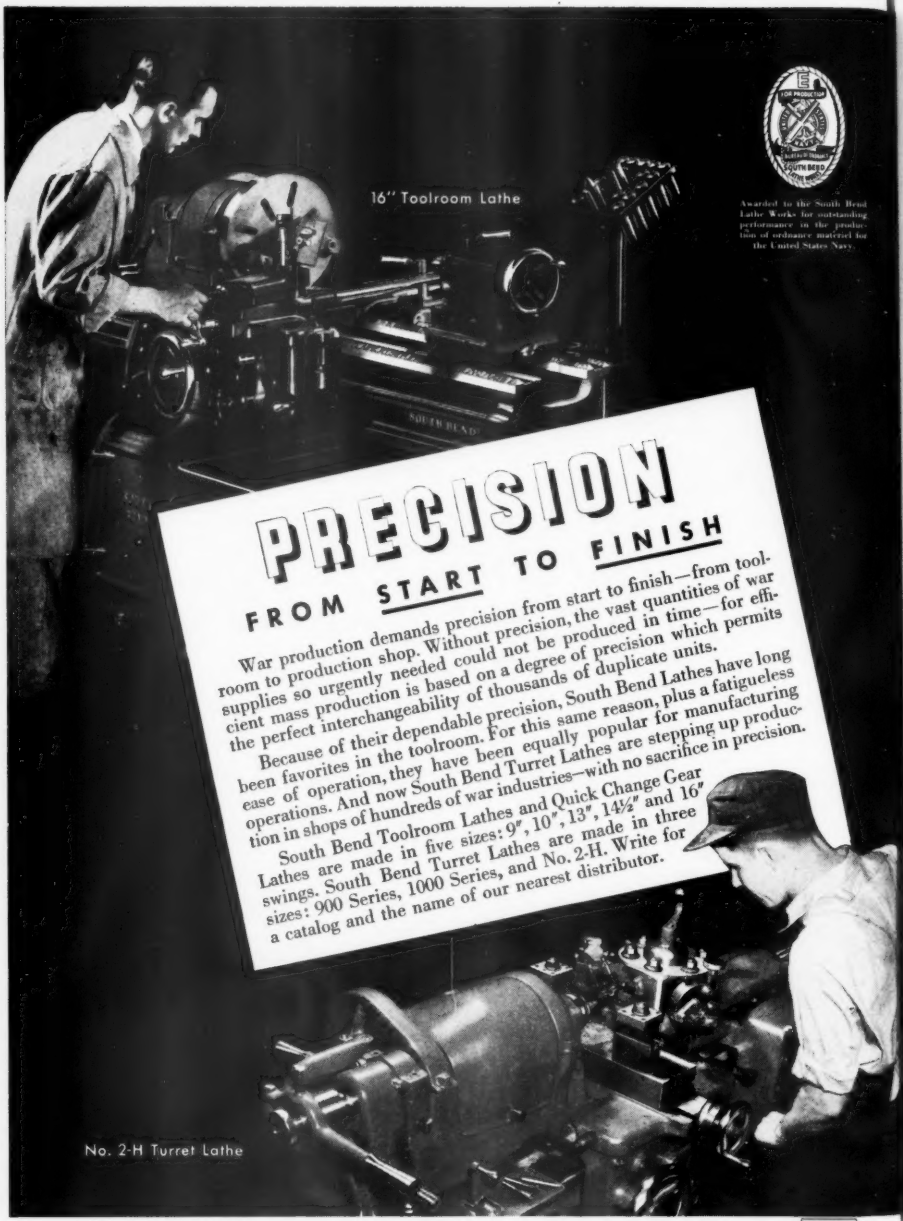
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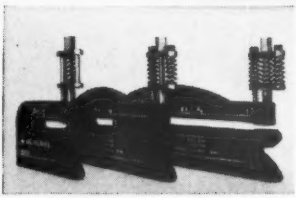
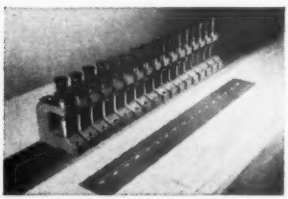
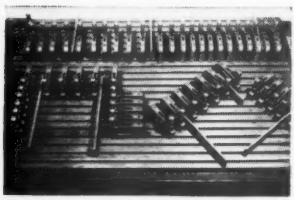


Above shows Wales "Selective Strippers" of 1, 2, and 3 interchangeable springs to provide the exact stripping action required for each job.



Gang of Wales Units on brake press rail.



Showing 3 set-ups of Wales Units on one T-slotted plate.

WALES

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Die setting time is reduced from hours to minutes by Wales patented holder which keeps punches and dies always in perfect alignment.

FEATURES OF WALES UNITS. Nothing is attached to press ram . . . self-contained punch and die holder . . . punch and die always in perfect alignment . . . each individual holder can be removed or reset on rails, templates or T-slotted plates instantly . . . punches, dies, guides, and strippers can be removed from holders quickly . . . interchangeable punches and dies punch various sizes and shapes with the same holders . . . irregular patterns of holes, not in straight line, can be punched with Wales Units . . . makes possible sliding one set-up out of the press and another pattern into position ready to operate . . . cuts die-setting time from hours to minutes . . . provides patterns unlimited.

Wales Punches and Dies are available in a wide range of standard sizes and shapes.

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Now Adaptable on All These Leading Machines

You are consuming much longer time than you should to perform cutting-off operations unless you are using Luers Patented Cutting-Off Blades. That's another way of saying that Luers Blades will enable your machines to turn out more cut-offs in any given time.

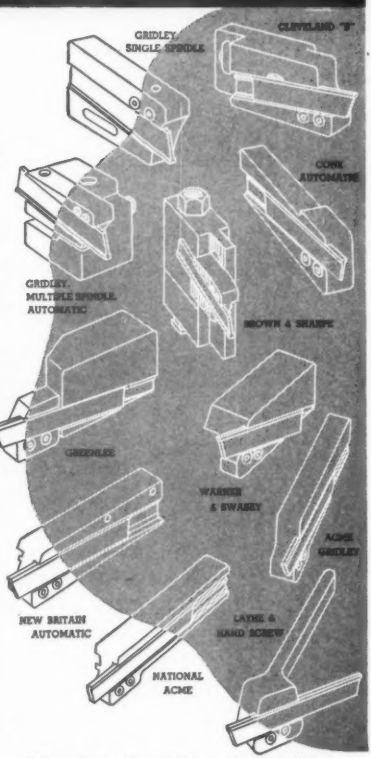
If you employ any of the machines mentioned at the right for cutting-off operations, tell us which they are and we'll send you a Luers Blade and Holder of the proper size and style and let you try it in your own plant under your own conditions.

You'll find you'll have fewer breakdowns, less frequent regrinds, and practically no downtime—AND MORE PRODUCTION. Due to the unique design of the blade, which provides the necessary side and back clearances, excessive friction is eliminated. Furthermore, the hollow-ground top of the blade permits the bursting chip to leave the cut without excessive friction.

The patented double cam lock of the Luers Holder not only grips the blade with exceptional rigidity, but it enables the operator to release the blade simply and quickly for resharpening and resetting without disturbing set-up.

The advantage of these features, plus the time-saving feature represented in the design of the blade requiring only one face to be sharpened, points to the marked reductions possible in downtime.

Thus it is apparent that these blades have an exceptionally high producing factor that deserves your immediate consideration.



Holders can also be supplied to meet any special applications on any other machines not mentioned above.

Luers Patented Cutting Off Blades and Holders are produced by Empire Tool Company under license issued by John Milton Luers Patents, Inc.

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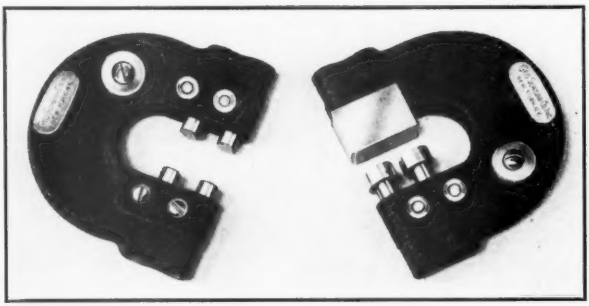
SNAP GAGES



Many plants engaged in war work are using Atlantic Adjustable Limit Snap Gages to quickly and accurately inspect parts urgently required. These gages are manufactured to American Gage Design Standards. Frames are made of Meehanite, a material that will retain its form indefinitely. Thousands of Atlantic Snap Gages are used daily in America's leading plants. When Snap Gages are used little dependence is placed upon the individual's measuring skill. After the gage is set, practically any operator can tell by the go and no-go parts of the snap gage whether the work under inspection has been produced to the correct limits.

Write today for folder showing all types produced.

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The SCHERR TOOL STAND is used as a vise or clamp for holding micrometers, snap gages and other tools. It eliminates possibility of error due to body heat which can distort micrometers and gages sufficiently to make accurate measurements difficult. The stand speeds up gaging since it frees both hands for checking the work, increasing skill and reducing fatigue. Price Scherr Tool Stand - - $7.50. Write for leaflet.

Illustrated above is Reed 1-2″ micrometer, now available in 1/1000″ and with vernier to 1/10000″. *Write for folder.* Reed Micrometers are also manufactured in 1″, 3″ and 4″ sizes.

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THIS bulletin may solve your tool problem. It shows stock sizes and prices of Victory Tool Shanks—cast of tough, durable Meehanite. They come semi-finish ground, ready to affix your own carbide tips.

If you tip your own cutting tools, you'll want the details given in this illustrated booklet so you can place a trial order. Small quantities of stock sizes shipped within a few hours. Quotations on patterns and castings for special shapes furnished gladly. Write to

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Possibly we have solved your particular problem before and can give you the answer in a jiffy. If not, you can be sure that our long and varied experience will enable us to analyze your troubles in record time and iron them out with a minimum of delay.

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. . . Center Scope Puts You Ahead of the Crowd

We'd get nowhere *fast* on the "firing line" if our materials of war weren't better than those used by the Axis! The same is true on the production line, and that's where Center Scope enters the picture.

Center Scope will locate edges or layouts to the spindle axis, even "within a tenth." It is *fast* to use, and the operator can *see* that he is right.

With Center Scope—accuracy becomes a habit *regardless of who uses it!* It is not affected by wear, temperature or mechanical pressure.

Center Scope has many advantages of which price is vitally important. You can get your Variable Center Scope for only $97.00, f.o.b. Los Angeles, California. The Edge Block is $23.00 additional. Orders are filled promptly.

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The TOOL & DIE Journal

AUGUST, 1942 Vol. 8, No. 5

Letter from Washington

By George J. Huebner

Keys to Victory—
Desire, Exertion, Privation

EIGHT months ago United States abruptly realized that it must actively join the battle for world freedom. Today the fact should be faced that we must not only give every possible aid to our allies, but must fight for our own survival.

We are NOT winning the war; we can lose and will lose unless an "all out" effort is made. It is equally true that we can win and will win if we have the same desire to defeat our enemies as they to defeat us.

The Office of War Information sums up the situation as follows:

> "There is no doubt that the American people mean to win the war; but there is doubt that all of us realize how hard we are going to have to work to win. The war is still a long way off, thanks to our good luck and the stubbornness of our allies; but it may not stay a long way off unless we work harder than we are working now . . . .
>
> "Too many people seem to feel that we are fighting this war out of a surplus—a surplus of resources and productive capacity, a surplus of time. That is not true . . . .
>
> "It is a total war, in which defeat by our enemies means destruction . . . . To win a total war we must fight it totally, and we are not yet fighting it that hard . . . . Many individual Americans have made great sacrifices, but as a nation we are not yet more than ankle deep in the war . . . . We have done fairly well, but fairly well is not enough. Nothing will be enough until we have won."

American soldiers, sailors and marines have proven their ability to win battles but not without munitions—guns, tanks, planes and ships.

American industry has equally proven itself in manufacturing technique and productive ability. A great war machine is in the making. Its efficient operation depends on each of us individually and collectively. It requires the total attention and effort of all. Certainly Victory, and the lasting peace it insures, is worth such effort.

Suttonizing — A Welding Process for the

Reclamation of High Speed Steel Tools

Discussing a solution to America's critical Tool Steel shortage

DONALD M. NELSON, War Production Board Chief, has put it up to American Industry to make better, more economical use of the country's critical materials. He made it another challenge to Industry, not alone to the executive and his operating key men, but to the man on the production firing line.

If some of us are to stay at work, it will be necessary to do "more and more with less and less". Among the most important shortages is tool steel and consequently tools of almost every description. Standard types of catalog tools are difficult to obtain. Delivery promises are months in the future. The large volume of special tooling, which includes dies, jigs, fixtures, molds, special cutting tools and special gages, is taking up available facilities in Contract Tool and Die Shops and in tool rooms of manufacturing plants. With most parts production requiring extensive tooling, the demand for tool and die steels and high speed steel has been increasing continually. Some of the mounting requirements have been wholly justified based upon the larger volume of tools required but it should be possible to eliminate the need for a substantial part of such excessive demand. This is the problem that Mr. Nelson puts up to the manufacturer and the tool maker.

Tools broken before they have delivered their full measure of production service constitute one of the typical critical problems which must be solved by Industry. The first step naturally is better training and supervision of workers to insure more accurate set-ups and much more careful use. The second solution is the effective reclamation of tools which have been broken or worn. Effective tool salvage thus becomes a "tool life-saver". It restores to useful service the tool which consists of a critically scarce material and of vitally necessary labor constituting an investment which has been mishandled. Every such tool that is returned to efficient service in the production line eliminates the necessity for duplicating the material of which it is made, the labor which has made it and the use of the equipment upon which it has been made.

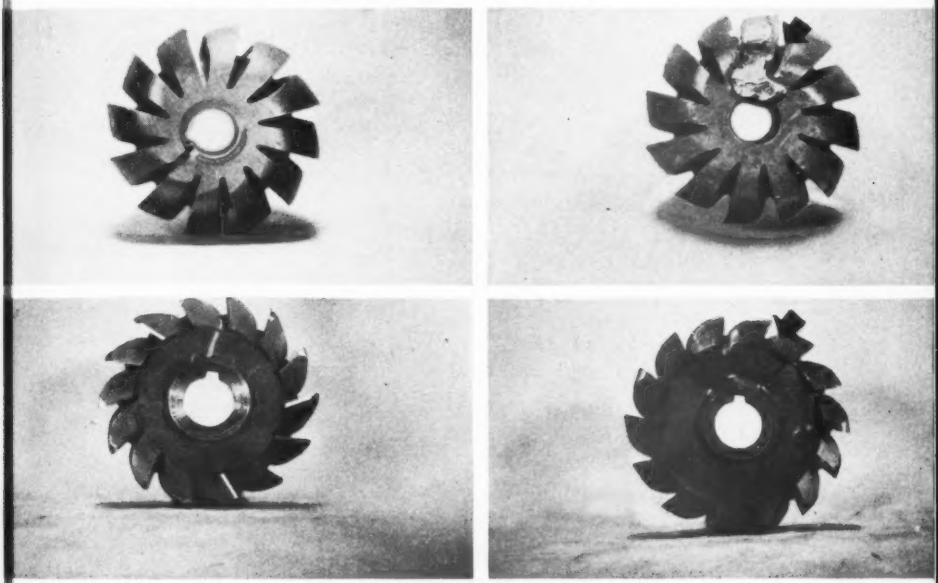
Notable among the processes for restoring worn and broken tools to active service is welding. Among the special-

ized processes more recently developed is Suttonizing. It has the advantage, in most instances, of not requiring subsequent heat treatment of the tool. Neither is it necessary to anneal before reclamation, thus considerable time is saved and the possibility of dimensional distortion frequently encountered in heat treatment is greatly lessened. It is desirable, in fact, that the reclaiming of both small and large broaches be accomplished without heat treatment, particularly when repairs must be made to the teeth. If

cial forming tools. Suttonizing is said to differ from so called insert methods because the deposits of alloys made by the welding process become integral parts of the tools, thus reducing the susceptibility to rebreakage.

In the development of the Suttonizing method, the goal was always to obtain deposits that would be hard "as welded" and which would require no subsequent heat treatment. It became apparent that two important elements would enter into this accomplishment: 1. a scientifically

Below — Before and after (arrow) fractured ball mill was repaired and refluted by Suttonizing. Rough ground but ready for use.



Above — Fractured milling cutters repaired by Suttonizing. Rough ground but ready for use.

heat treated after reclamation, it is almost impossible to hold a broach in required alignment.

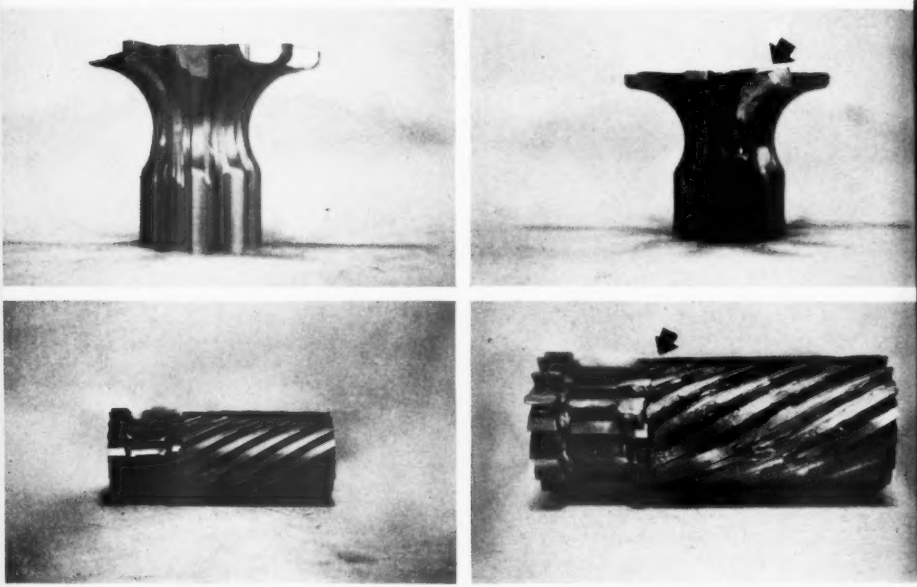
Suttonizing is being employed effectively for repairing teeth, flutes, tangs, shanks and fractures on milling cutters, broaches, drills, mills (including large size Ingersoll ball type), cutting tools for lathes, planers and shapers as well as many kinds of difficult shapes of special forming tools. Suttonizing is said to differ from so called insert methods because the deposits of alloys made by the welding process become integral parts of the tools, thus reducing the susceptibility to rebreakage.

In the development of the Suttonizing method, the goal was always to obtain deposits that would be hard "as welded" and which would require no subsequent heat treatment. It became apparent that two important elements would enter into this accomplishment: 1. a scientifically compounded welding rod, and 2. truly scientific technique. Experimentation apparently indicated that a conventional high speed steel rod was not satisfactory for obtaining the necessary air hardening deposit in the welding zone because such steel requires its conventional heat treatment which includes an oil quench. The typical hard facing rods and the conventional Cobalt base hard

facing rods were experimented with and while deposits of them were hard "as welded" their abrasive resistance complicated grinding procedure. In contrast, the rod developed for and used in the Suttonizing process is described as making it possible to combine the cutting qualities of conventional high speed steel with abrasive resistant qualities which, in some instances, have proven almost equal to those of tungsten carbide. At the same time, little difficulty is experienced in grinding as the deposits are its from this process are homogeneous and will match or in some instances excel the original hardness of the tool being welded.

As was previously mentioned, the Suttonizing process requires no preliminary annealing of the tool. However, it does involve a technique for pre-heating before welding in order to eliminate the necessity for heat treatment after welding. The maintenance of a constant preheat during the welding operation and

Below — Before and after (arrow) one tooth was replaced on special form cutter by Suttonizing. Rough ground.

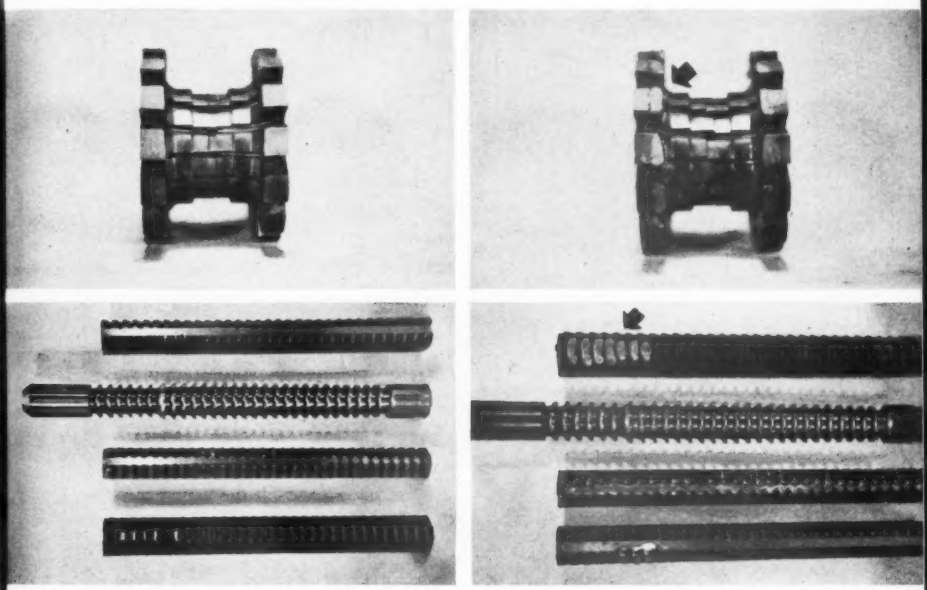


Above — Before and after (arrow) a series of interlocking cutters were repaired by Suttonizing. Rough Ground.

as easy to grind as conventional high speed steel. Thus, the combination of fine cutting qualities and wear resistance in the structure of the weld can be a solution to many cutting tool problems. The Suttonizing process is not only applicable to cutting tools but also can be used on tools requiring resistance to abrasion *only* such as lathe centers, centerless grinder rests and spinning tools. Deposskill in proper post-heating are of vital importance. Air hardening of the deposits keeps decarburization to a minimum. Highest cutting efficiency is secured by making a maximum deposit depth of ¼". In this process no appreciable reductions in hardness adjacent to the weld deposit are encountered. The small depreciation that may result (maximum of two points Rockwell) is offset by the

superior cutting qualities of the deposits. Contours on most tools can be maintained in the welding operation, minimizing the amount of grinding necessary. It has been reported that in some cases high speed steel tools, faced by the Suttonizing method, resulted in three times as much production on one regrind as was experienced with a new tool. The Suttonizing method can also be used for the composite construction of such tools as the lathe, planer, boring, cut-off, shaper and special shaped forming tools.

Below — Before and after (arrow) set of special form cutters were tipped to offset wear on upper radii.



Above—Before and after (arrow) teeth on special broaches were replaced by Suttonizing. Rough ground.

In this instance the technique involves facing the cutting surfaces of an S.A.E. steel of the 1335 variety. Approximately 90% of the tools thus constructed can be used immediately after grinding as the method and technique eleminate heat treatment after welding. Conservation of our present stock of high speed steel results and quick delivery of much needed tools is assured.

THE TOOL & DIE Journal has, in the past few years, published various editorials relative to the reclamation of standard and special cutting tools. As an aid to those companies doing war work, attention is again drawn to these earlier articles.

In the April issue (1938), "Hard Chrome Plating, a Solution for Many Problems of Undue Wear", took up the wear resistant tendencies of hard chrome and how it increased the wear life of machine parts, tools and dies. The distinction between chrome plating for surface finish and hard chrome deposited directly on the metal for wear and corrosion is pointed out. Today thousands of new machine parts and tools are being plated to insure a minimum of wear, and worn tools are being reconditioned so that they can go back into service.

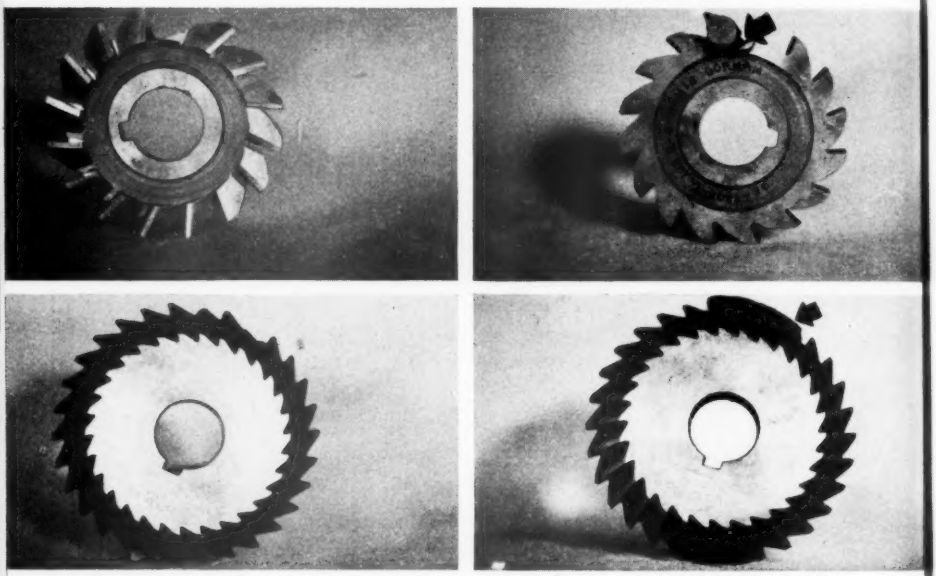
The August issue (1941) carried the story "New Composite Steel Blanks Conserve Strategic Tungsten". A new line

of electrically welded composite steel blanks for the making of dovetail forming cutters for use on automatic screw machines was discussed. According to the manufacturer, the bond between the high speed steel cutting face and the soft steel base is inseparable; and, unlike some methods of alloy conservation which involve principally the use of substitutes, these composite steel blanks offer distinct advantages of their own over the usually solid high speed steel construction that they replace.

back of each tooth to displace only enough metal to increase the size of the desired amount. This forging operation on each tooth of the reamer increases the height of the tooth sufficiently to restore the reamer to its original size.

The April 1942 issue also contained the story of "Victory Tool Shanks", made of high tensile Meehanite for conserving strategic materials. They are intended for those users whose shops are equipped to tip their own cutting tools. The shanks are cast to shape with rake

Below — Before and after (arrow) milling cutter-tooth was replaced by Suttonizing. Rough ground.



Above — Before and after (arrow) teeth on milling cutter were replaced by Suttonizing. Rough ground.

April 1942 carried information for restoring worn reamers to their original size. The restoration process is accomplished with a specially designed die and mechanism. Penetration of the punch on the back of each tooth is controlled as to depth from the point of contact so that the tooth is extended uniformly throughout. The depth of the forging print is gaged from the surface of the and clearance angles included, thus saving the user much grinding time.

If reprints of the above mentioned articles are desired, kindly address The TOOL & DIE Journal, 2460 Fairmount Blvd., Cleveland, O.

A Series—VIII

Modern Milling Fixture Design

by C. W. Hinman
Designing Engineer

END mills are used for a large variety of milling operations such as profiling, slotting, end milling and surface milling. They are made in the following styles: end mills with straight shanks; end mills with tapered shanks; two-lipped end mills with straight shanks; two-lipped end mills with tapered shanks; and shell end mills.

The angular end milling cutter, shown finishing a dovetail slot in Fig. 42, is mounted on a screw arbor (sketch *A*). A counterbored relief around the tapped hole permits a shoulder on the arbor to register against the cutter. These cutters are usually made to fit Brown & Sharpe tapered arbors Numbers 7 and 9. The cutter itself is 1⅝" in diameter; $\frac{9}{16}$" thick; has a ½-20 National Fine thread tapped hole; and is provided with 12 teeth cut to an included angle of 60°. Vertical cuts can be made as shown for the dovetail, or the arbor and cutter can be used horizontally as seen at *A*.

The face of this cutter is relieved as shown at *B*, in sketch *A*. This relief removes the tooth space around the center of a "dead" area where no cutting could be done and also provides additional chip and friction clearance. These cutters are made either in rights or lefts, each with a right or left hand thread as required. New milling cutters are made with a width of tooth "land" *C* of about $\frac{3}{32}$" unless it is a "formed" cutter. When the teeth become dull, they are ground with the cutter mounted on the arbor and each tooth land is ground with a slight clearance angle back of its cutting edge. Grinding increases the width of land and in most cutters it also reduces the diameter and cutter thickness. In time, many such grindings finally reduce the size of the cutter too small for efficient use. Such worn out cutters must be scrapped. The larger ones, however, may be reclaimed by cold water regrinding which reshapes the teeth. This is done at shops where such work is a specialty. In some instances, large worn out cutters have been reground and restored to a condition practically the same as new but of smaller diameters and thicknesses.

The work, for end milling the dovetail, is clamped between jaws of a milling vise. As is the case with most end milling operations, they are used principally in tool rooms, and not often for milling parts in mass production, except for simple spot facing operations or for shallow profiling cuts.

Profile Milling

Fig. 43 illustrates a typical operation

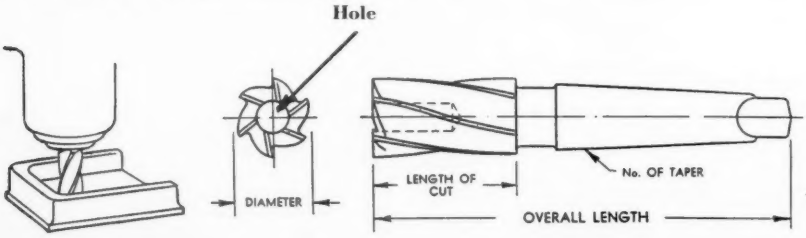
(*A*)

Fig. 42 — Dovetail cutter with threaded center hole. These cutters are used for milling inner and outer longitudinal angles; they are made either right or left hand.

for a profile milling cut. The work is secured in a milling machine vise (not shown). This is a solid one piece spiral cutter as seen at *D* where the necessary dimensions are indicated for making such cutters. The hole in the end of the cutter is for grinding wheel clearance when resharpening the ends of teeth. Solid end mills, ½" in diameter and over, are made with a deep center hole to permit many regrindings. Obviously, in two-lipped end mills this hole is omitted because the end cutting teeth must necessarily meet at the center of the cutter to give it strength.

When these types of end mills have 8 to 12 teeth they are sometimes called "butt mills". They are commonly used for spot facing, profiling straight or irregular longitudinal slots. The side teeth are used for milling the edges of cam disc lobes similar to those used in automatic screw machine cams. They are also used for milling arcs on the edges of discs and for cutting scallops or irregular curves. The directions of the cuts are controlled by movements of a so-called "spiral head" milling fixture on which the work is mounted. This fixture is bolted on the table of a universal milling machine when in operation. A center hole in the work disc is placed over a threaded stud in the spiral head. The disc is then securely clamped with a washer and a nut. Next, the work disc is advanced by the lateral movement of the table until the edge of the disc is finally brought into easy cutting contact with the side of a revolving profiling cutter. From here on, the contour of the cut depends upon the arrangement of a set of change gears for the spiral head and the use of the regular feeding mechanism for the universal milling machine table. By consulting change gear tables and inserting the proper gears it is then possible to make any desired spiral cut during the circular revolution in conjunction with the lateral movements of the table and work. The whole scheme is plainly shown by the set-up in Fig. 44. In Fig. 45 are four sketches of standard end mills that show the meaning of such commonly

Fig. 43 — Straight shank spiral end mill shown in the operation of profile milling the interior of a block and leaving a floor.



(*D*)

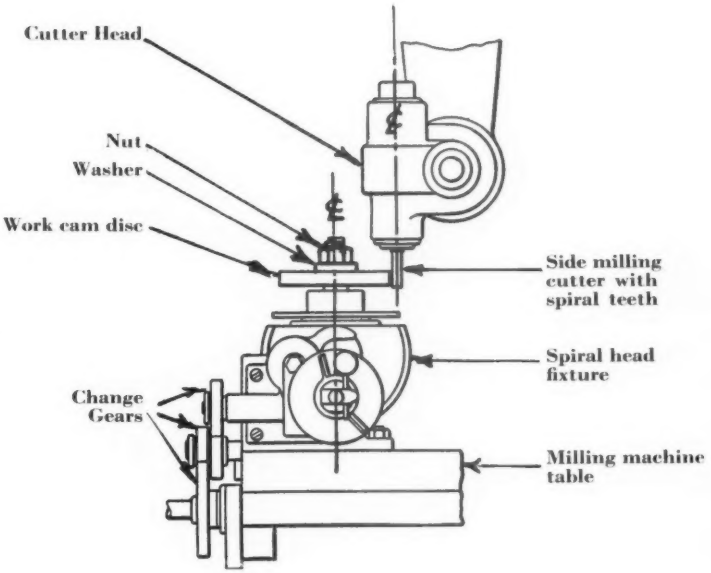
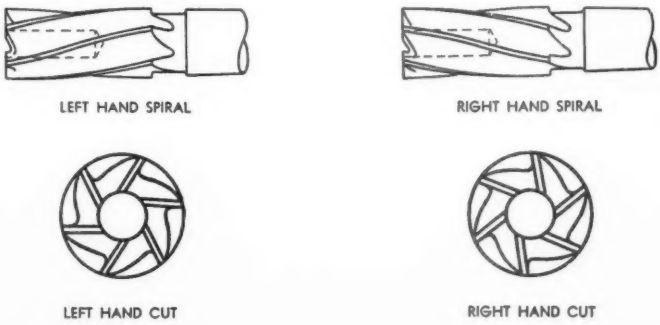


Fig. 44 — A Brown & Sharpe spiral head, set up on a universal milling machine table, shown ready to mill the edges of a cam disc. By inclining both the spiral head and cutter in line, and to other angles, and then changing the gears, an endless variety of spiral cuts can be obtained. When changing the angle of the cut, the center lines of the cutter head and fixture must always be parallel, if a square cut edge is desired.

Fig. 45 — To clarify the terms used in connection with spiral types of end mills, the illustrations below show exactly what is meant by "right hand spiral" and "left hand spiral" cutters and cutting teeth.



used terms as "right and left hand spiral cutters" and "right and left hand cuts," respectively.

T-Slotting

Fig. 46 shows the operation of a T-slot cutter where five surfaces are being finished with one tool. The cutter teeth are staggered to cut at both top and bottom of the slot. Some types of side milling cutters also have staggered teeth. The side teeth in staggered cutters are chip conveyors and are not sharpened, but they have a slight back clearance which tends to maintain their size after grinding. T-slotting cutters are made in one piece and are furnished both right and left hand, usually with Brown & Sharpe taper shanks. It is often necessary to make two or more cuts in the slot in order to produce full sizes.

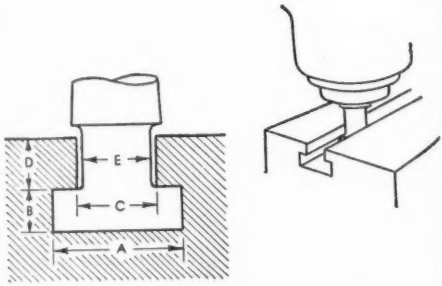


Fig. 46 — Standard T-slot cutter milling a longitudinal bolt slot in the surface of a machine table.

Gashing

It is good practice when cutting teeth or slots across the edge of a work disc, especially when cutting gear teeth, to first take one light cut and then index the fixture and blank one tooth space. Then continue to repeat the light cuts throughout the entire circle. This procedure is called "gashing" and shows the operator whether or not the spaces between the teeth are equal—especially between the first and last cuts. Fig. 47 shows a single angled milling cutter in operation cutting teeth in a circular blank. A fixture arbor on which the blank is mounted and clamped passes through a center hole in the work. The arbor is indexed by using the holes in a circular plate attached centrally at one end of the arbor.

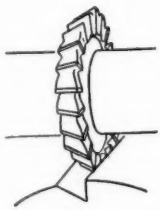


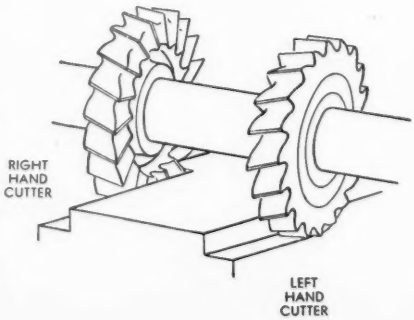
Fig. 47 — Single angle milling cutter machining a notch or tooth space in a circular blank. This operation, under certain conditions, is sometimes called "gashing".

Straddle Milling

A typical straddle milling operation is seen in Fig. 48 in which half-side spiral tooth cutters are used. Half-side milling cutters are made for heavy duty operations. With these cutters only the inner sides and the faces are provided with teeth. In gangs of two half-side cutters, as shown here, right and left hand cutters are necessary. The spiral flutes provide a positive rake for the side

(Continued on Page 102)

Fig. 48 — Right and left hand half-side straddle milling cutters shown machining notches at both corners of a piece of work simultaneously. The face teeth are cut spirally, as shown.



Salvage and Conserve by

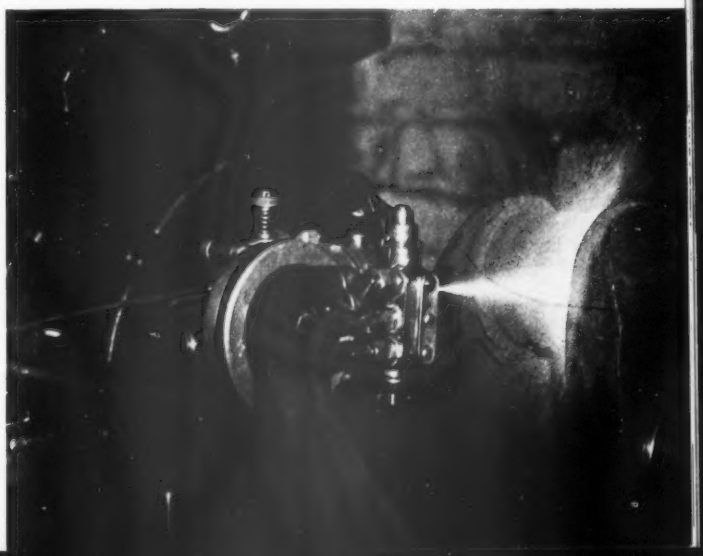
Metal-Spraying

The immediate future on the American Industrial Front holds many changes both in technique and procedure. If the war effort is to overwhelm our adversaries every bit of American ingenuity will have to be utilized. The process of metal-spraying worn machine parts is just such an example of "Yankee Ingenuity" which we pass along for those who have a genuine need for this conservation measure.

YOU will hear more about metallizing, a process of metal-spraying worn machine parts for repair and salvage purposes, as America's War Plants endeavor to satisfy their giant appetite for metals and alloys. The belt of conservation will be pulled one notch tighter in the days that lie ahead.

General Electric, who use metal-spraying with stainless steel to renew the hundreds of carbon steel rams in the hydraulic presses of their plastics department (the said rams formerly pitted badly in service), term the process "a salvage tool of the first order." Their first tests indicated the sprayed rams would last at least five years before recoating, and recent checks have upped the estimate to ten years. As a result, they also found it advisable to stainless-spray new rams.

Many consider metallizing a new science, but its origin actually dates back to 1882, when the first metal-spraying machine was built for the purpose of producing lead powder to be used in making accumulator plates. No one thought about it at the time as a method of metal coating a base material; that conception had to wait until 1909, when a Swiss engineer, Dr. M. U. Schoop of Zurich, happened idly to observe the small area of lead coating left on the garden wall where the pellets from his



Metallizing causes no distortion, crystallization, or stress in the piece resurfaced. This gun is spraying ⅛ inch of chrome steel on a crankshaft.

children's air rifle had struck.

The observance set off a long chain of investigation. Early experiments utilized a cannon principle, then seized on something similar to the metal-sprayer used to make lead powder, finally evolved a commercial machine which would spray adherent coatings but was large, unwieldy and stationary—capable only of very limited usages.

Portability was the thing needed and Dr. Schoop's mechanics finally got it, evolving a wire-fed "gun" in which the wire was melted by an annular flame, which, as fast as melted, was atomized by an annular blast surrounding the flame. Modern wire-fed metallizing equipment, although much faster and more efficient, operates on exactly the same principle as the original gun produced 30 years ago.

Unfortunately, metal-spraying got off to a bad start. Introduced shortly before the first World War, such a new and untried process had natural difficulty in gaining recognition. Furthermore, after the war it was not only licensed under too heavy restrictions but was exploited too much, with many claims made for it which were not supported by the results secured. Some splendid work was done by those who understood its limitations, but on the whole, metal-spraying received a black eye which it still wore up to the early Thirties.

Then new ideas entered the picture and the metal-spraying process was groomed for a comeback. Causes and effects were analyzed, methods were developed and standardized, and an intelligent survey made to find out just where the process fitted into the industrial scheme. As a result, metal-spraying came into its own; and the Metallizing Company of America, Inc., better known for its Mogul Metallizing equipment and methods, intends to see that the process remains within its limitations and in good favor.

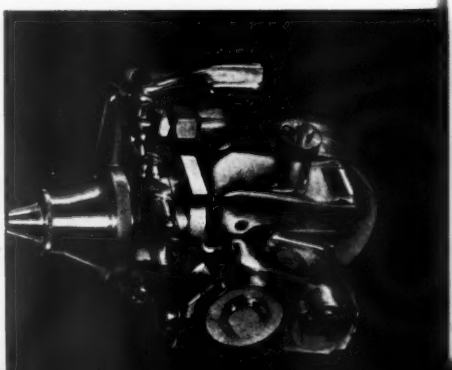
Originally, metallizing was confined largely to the spraying of flat surfaces, ennobling them for artistic purposes or protecting them against corrosion. Such permanent objects as bridges, water tanks or gas holders, for example, received lasting protection at small cost with a few thousandths spray-coat of zinc. In the last ten years, however, the process has developed along more diversified lines; and at least one branch of it, the rebuilding of worn machine elements, has become an industry all its own.

This subject reaches into all industries and covers thousands of applications for every one we might touch upon here. But in general, repairs can be made with great ease and rapidity. The results are highly satisfactory, so much so that the repaired part is often actually superior to the original.

For instance, the repair of cavitated cast iron or bronze water wheels with a spray-coat of chrome stainless steel is an established practice with hydropower companies and it considerably reduces further cavitation.

Oil companies, paper mills and chemical plants with corrosive conditions requiring alloy pump rods and plungers repair such parts, when worn, with a coating of 18-8 stainless or with a high chrome where excessive wear is encountered. The pumps are vital in wartime, yet spare parts might be long delayed or even impossible to secure. Metallizing produces the equivalent of new parts with the expenditure of comparatively little critical material.

Then there is the ability of sprayed metal bearing surfaces to wear 10% to 50% less than the original solid surface. The phenomenon applies to both members of the bearing and has been shown conclusively in tests and in actual extended service. Two factors probably



The "Mogul" Metallizing Gun can apply 7 to 10 lbs. of stainless steel per hour in rebuilding worn surfaces.

account for it: the surface hardness of the coating metal and its somewhat porous nature, which absorbs oil and, incidentally, practically eliminates the chance of seizure.

As a result, some of the ordinary applications are those that apply to all classes of Diesel engines. Building up and finishing the journals and throws of crankshafts to standard size is everyday practice. Such other parts as pistons, piston pins, cylinders and cylinder liners, the bearing surfaces of cam shafts, water pump shafts and valve stems are also economically coated and reclaimed.

Other comparable work includes such items as steam cylinders, pistons, valves, piston rods, oil pump plungers, armature shafts, locomotive axles, lathe spindles, lithographic rolls, clutches and press cylinders. In fact, the record of metallizing covers almost anything you can name, from press fit build-ups to the resurfacing of stator lands in large steam turbines. The metals sprayed vary with the mechanical requirements, but the chrome nickel steels are most extensively used. They spray well and possess the qualities desirable in this class of work.

Metallizing is not an expensive process. Compared to the replacement value of the part involved, the cost will run from 5% to 40%. Mogul "guns" can apply 7 to 10 pounds of stainless per hour, and no distortion, crystallization or stress are set up in the piece. It matters little where the work is to be done, how large the area to be coated or what metal is to be applied. Any metal obtainable in wire form can be sprayed.

The big thing to remember is that the bond between base metal and coating is purely of mechanical nature and that provisions for insuring a strong bond are essential to the success of the spray job and the usefulness of the part repaired. Of the three steps in metallizing—preparation, spraying and finishing—the first is a highly important operation on which the Metallizing Company lays proper stress.

The company's service engineers teach the preparation technique as well as the use of Mogul equipment. If metallizing

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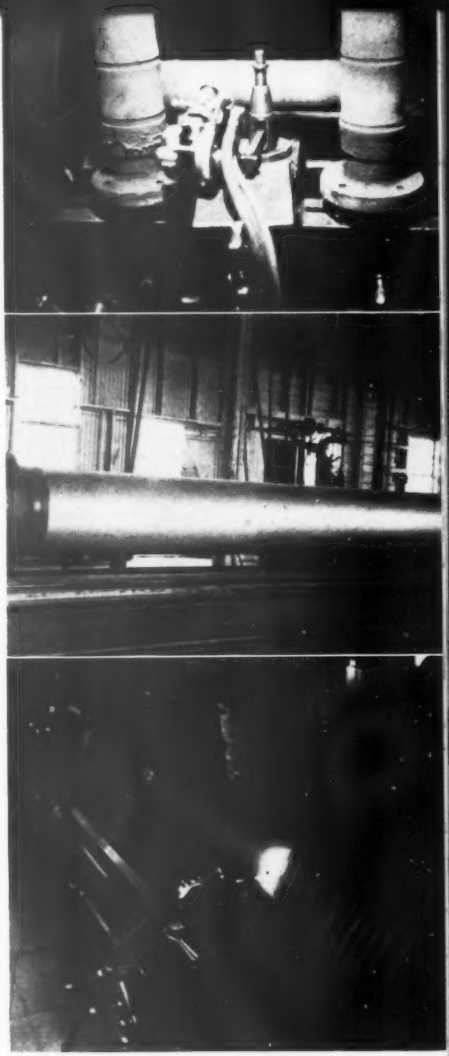


Top — Three steel pump plungers that have been built up with 18-8 stainless steel. They are now ready for the finished machining.

Middle — Cast iron ram in a textile mill, which would formerly show corrosive action and pitting, as much as ¼" in depth over a period of one to two years. These rods are now built up with ¼" of 18-8 stainless and corrosive action and pitting has been eliminated.

Bottom — A 7⅛" diameter piston rod for a Worthington Gas Compressor engine is reclaimed by the Southern National Gas Co. by spraying with a high chrome stainless steel.

VICTORY DIGEST

IN a further move to eliminate bottlenecks in the manufacture of machine tools, the WPB prohibited production of tools calling for special electrical specifications after July 15th.

Special electrical specifications include non-standard types of electrical controls, motors and other equipment not normally used by machine tool makers. They also include methods of attachment of such appliances which represent departures from the usual technical practices.

★ ★ ★

TUNGSTEN, an essential ingredient of hardened steel critically needed in War Production and armament, was placed under further allocation and end-use control by an amendment to General Preference Order M-29, issued by the Director of Industry Operations.

The principal effect of the amendment is to place under complete allocation and end-use control all tungsten ores and concentrates.

★ ★ ★

THE United States produced in June almost three times as much munitions as in November, WPB Chairman Nelson revealed recently. His special report showed large increases in output of all the several classes of arms, but he warned the Nation against "undue optimism over these proportional gains." "When an economy is converted from peace to war", he said, "production for war purposes inevitably goes up".

TO speed the war effort, makers of new machine tools have been authorized to enter into contracts and make deliveries at prices above established maximum levels while awaiting formal rulings from OPA on the petitions they must file when they seek increased prices.

This authority was granted in Amendment No. 12 to Revised Price Schedule No. 67.

★ ★ ★

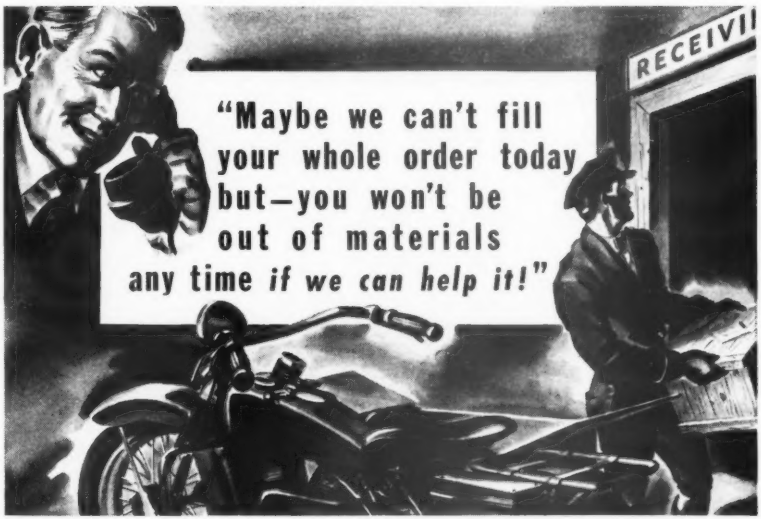
SPECIFICALLY defined restrictions on production and delivery of new plastics molding machinery are imposed by provisions of Limitation Order L-159, announced by the Director of Industry Operations.

The action was taken to prevent production of such machinery for non-war purposes.

The machinery covered by this order includes such presses for plastics injection molding; plastics compression molding—hydraulic, automatic, mechanical; plastics extrusion molding; plastics preforming; plastics laminating; plastics tube and rod molding; plastics bonded plywood veneer and plastics tube rolling machines.

★ ★ ★

IN order to facilitate authorization of critical raw materials to companies operating under the PRP during the fourth quarter, a supplementary material information sheet, use of which is optional, has been added to the revised Form PD-25A.



This is your Industrial Supply Distributor's pledge to help you keep your contracts moving with never the loss of a minute's production if it can be avoided. It means he will put forth every resource to keep you furnished with the vital supplies and equipment you must have to keep up your share of the War Effort.

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4—They know Priorities and can help you obtain essential materials in cases where you do not have blanket authorization.

5—If they cannot complete your order in one delivery they usually can rush out an emergency supply saying "here's enough to keep you going—more soon."

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This incident is typical of the unusual services that many Mill Supply Distributors are rendering their customers during the Emergency.

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Series F and G Bonds are intended primarily for larger investors and may be registered in the names of fiduciaries, corporations, labor unions, and other groups, as well as individuals.

The Series F Bond is a 12-year appreciation Bond, issued on a discount basis at 74 percent of maturity value. If held to maturity, 12 years from the date of issue, the Bond draws interest equivalent to 2.53 percent a year, computed on the purchase price, compounded semiannually. The Series G Bond is a 12-year current income Bond issued at par, and draws interest of 2.5 percent a year, paid semiannually by Treasury check.

SAVE WITH

War Savings Bonds

This space is a contribution to America's All-Out War Program by

The Staff of
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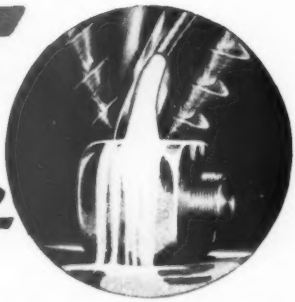
SAVE CUTTING TOOLS-



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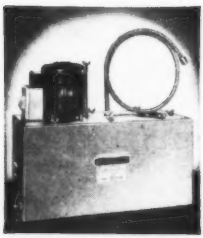

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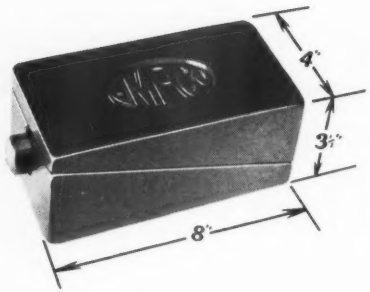

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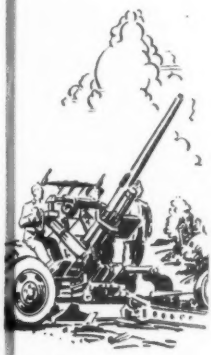
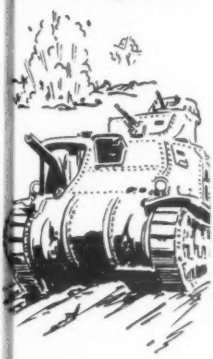
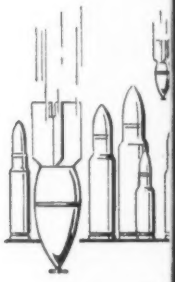
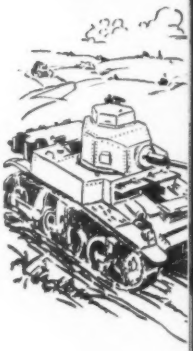


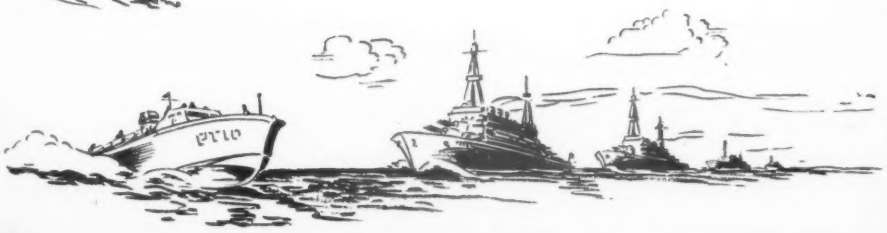
WAR has placed a new value on the use of plastics. Designers, engineers and production men faced with metal shortages turned to plastics and found a new and unbounded field. New designs and production techniques in plastics fabrication are today utilized in Military, Naval and essential civilian production. Tomorrow—the tomorrow that comes after the peace—plastics will take an undreamed of place in our economic system.

The Plasticator will present new developments in mold design, production and finishing methods, and similar fabrication subjects.









PLASTICATOR

Finishing Methods and Equipment for

Molded Plastics

Second in a Series

Drilling

IT is often inconvenient to core all of the holes which are required in a finished molded plastics part. The diameter of a hole may be too small or the depth too great for a core pin to withstand the severe service without bending or breaking. To core a hole with an axis not in line with the opening and closing of the mold means extra cost in building the mold. Some molders prefer to drill such holes rather than depart from extreme simplicity of mold design. Others may prefer to spend the cost of the drilling fixture and drilling operation on a mold which will produce a finished piece. If a molding plant has extensive drilling facilities it is good policy to use them and make some gain on the investment while increasing the production of the molding plant through the use of simpler molds. Whatever the preference of the molder or plant layout limitations, there is plenty of drilling to be done in plastics finishing.

Perhaps the simplest drilling operation is reaming flash from cored holes. This flash is usually paper-thin if core pins are in good condition and the reaming operation is very fast. Rates of two to three thousand holes per hour can be obtained, depending upon the amount of handling required during the operation. For reaming flash, a drill of the proper size is used and the molded piece is held in the operator's hand. Usually no fixtures or jigs are required. When several holes of different sizes are to be reamed on a single part, a multiple spindle drill press is set up with the various size drills in the different spindles. The spindles are clamped in the vertical direction and the piece is pushed onto the drill by hand. The operator works out a sequence so that he does not have to put the piece down during the several operations on the drill press. There is no great danger to the operator's hands when the flash is not too thick or when the piece is large enough to be grasped securely.

Another difficult drilling operation is completing to depth holes which are spotted in the mold. For this type of operation a jig may not be required to locate the holes but a fixture which may or may not clamp is employed. The fixture determines the direction of the hole and the travel of the drill is set to produce the proper depth. Fixtures of hard wood or of low melting metal alloy are suitable for surprisingly long runs—100,000 to 500,000 pieces. Spotting holes in the mold and subsequently finishing them by drilling in wooden fixtures is a method of conserving cold rolled steel,

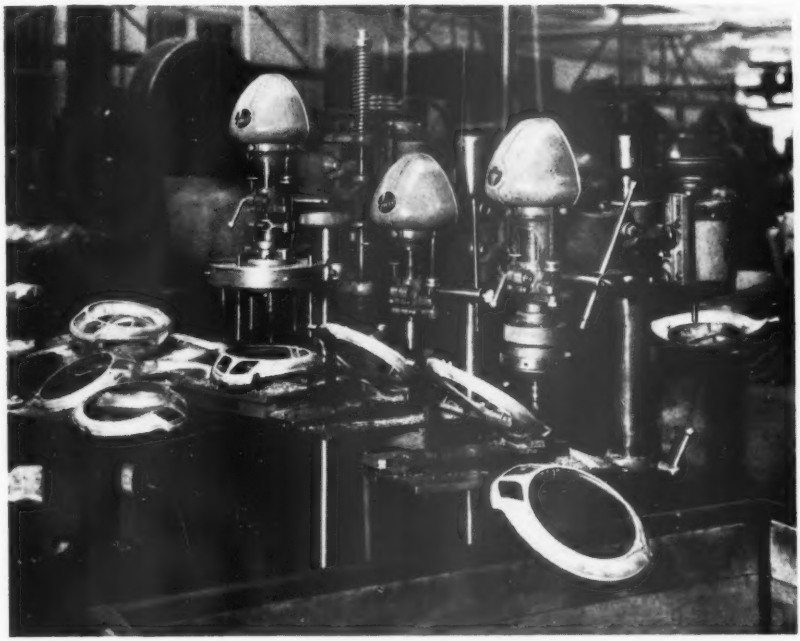


Photo Courtesy Delta Manufacturing Co.

The multiple head on the left drills and taps three cored holes at the same time.

alloy steel screws and bushings used in jig construction. However, the accuracy required in location of the holes should be carefully considered because this factor depends upon the skill of the driller and he may not always drill where the hole is spotted. Production rates vary from 1000 to 3000 holes per hour, depending upon the depth and size of holes and on handling conditions.

Jig drilling finds many applications in the finishing department. It is important to provide quick, convenient clamping and readily accessible holes in the jig bushings. The usual principles of jig construction are employed and hardened drill bushings are used. Jig drilling operations vary from 100 holes per hour up to 1000 or more. Multiple spindle drill presses are often used in conjunction with jigs and the handling time per hole is greatly reduced.

Drills with extra clearance on the edges of the flutes and with large helix angles are preferred for plastics drilling. The flute clearance prevents heating by friction of the drill in the hole and the large helix angle leads the chips out quickly. Heating is not such a critical factor with thermosetting materials as it is with the thermoplastics. The thermosetting materials do not melt, though they can be burned by an overheated drill. Most thermoplastics begin to soften at rather low temperatures—below that of boiling water. Once softened, friction is increased and much more heat is generated so the material then melts and sticks to the drill.

Drill points should be ground with an included angle of about 60°, which is sharper than the usual 120° used for metals. Cutting edges should be sharp and without too much rake, or with negative rake as used for brass. Some drillers prefer to thin the web of the drill to reduce the pressure required in feeding. This reduces the amount of heat generated at the point. Proper sharpening can raise production 50% to 100%

(Continued on Page 84)

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by Gordon B. Thayer

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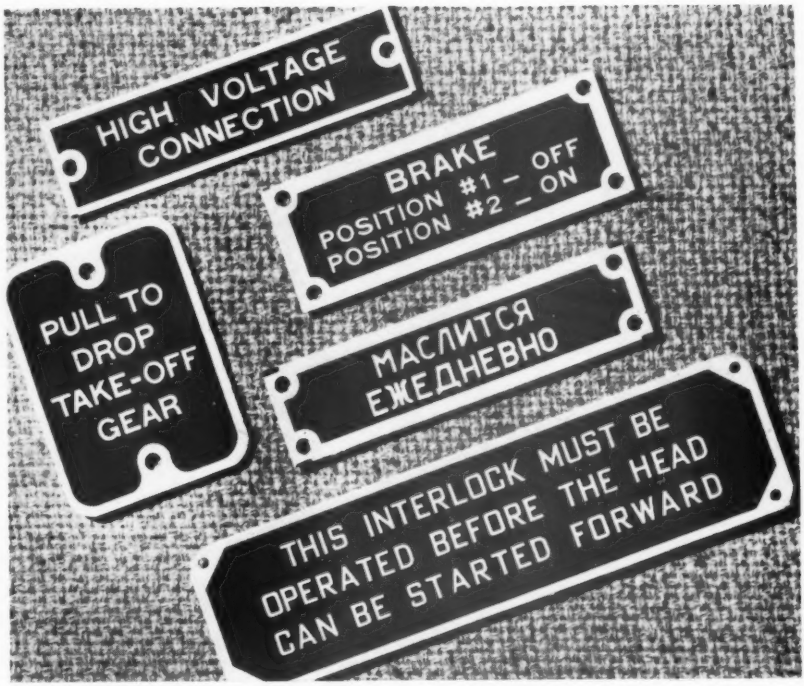
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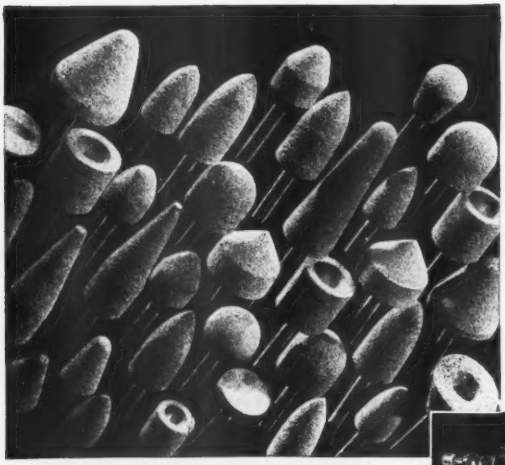

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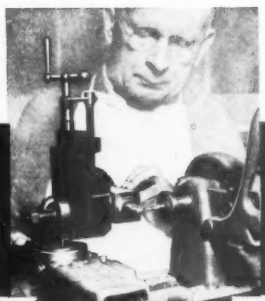
Index Fixture tilted at 30° milling end teeth in Taper Reamer.



Fixture and Base at right angles milling straight teeth in cutter.

Base of Fixture on 30° angle milling end teeth in cutter.

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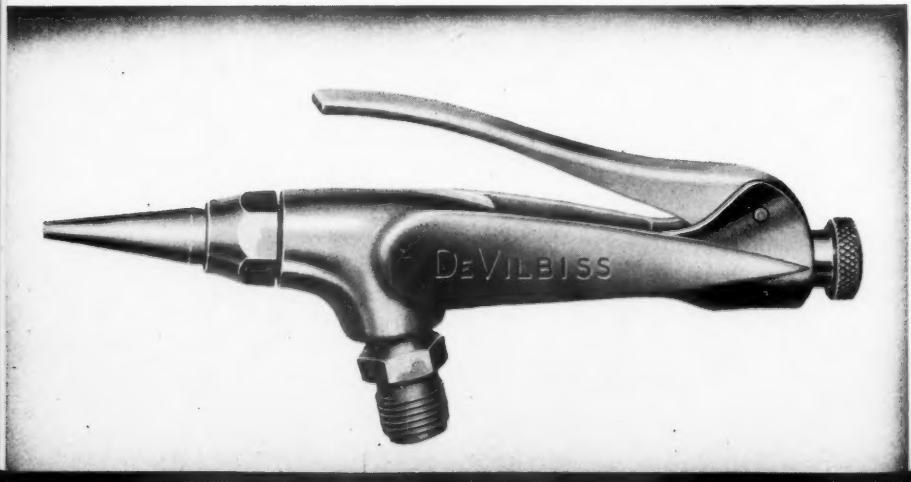
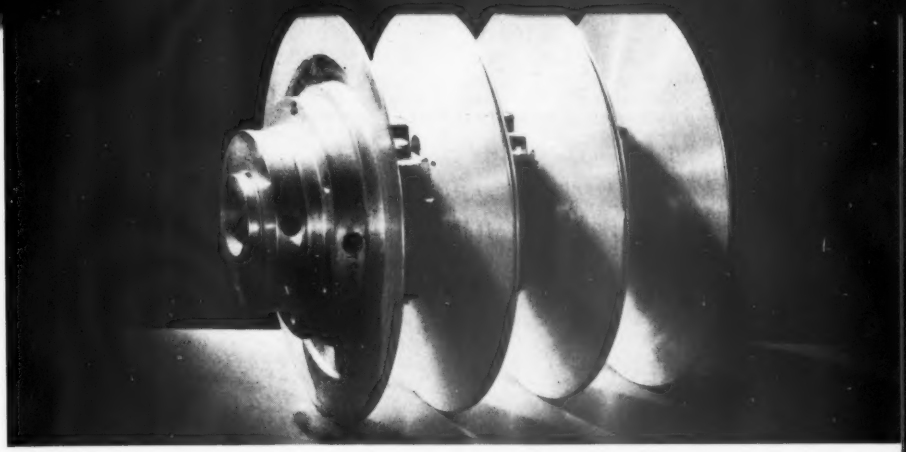
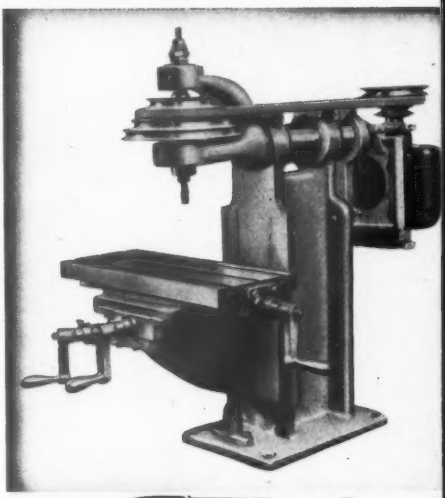
2 The new improved DeVilbiss Flow Gun is designed for caulking, cementing and other flowing operations where plastics materials such as crack fillers, sealing compounds and heavy paints are used. This tool is particularly useful in doping and cementing fabric parts of aircraft and for a wide variety of similar production jobs. The material is fed to the gun under pressure and the volume of flow can be controlled either by regulation of the pressure or adjustment of the fluid needle. Less restriction to flow and greater ease of handling are the chief advantages. Direct inquiries to The DeVilbiss Corp., Dept. J-8, Toledo, O.

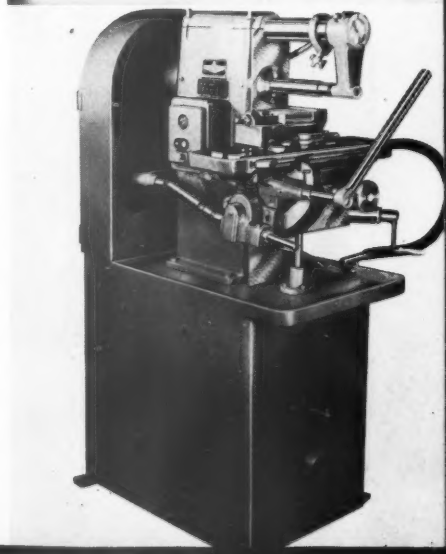




3 A new wide range Vari-Pitch sheave has been developed by the Allis-Chalmers Mfg. Co., Dept. TD, Milwaukee, Wis., to meet a wartime demand for power transmissions in wider ranges of speed variations. Manufactured in sizes to fit the shafts of all standard NEMA motors from fractional to 30 hp, speed variations from 66% to 116% are now possible.



4 For tool room or high speed production lines, this new precision vertical bench milling machine has just been announced by the Duro Mfg. Co., 808 E. 61 St., Los Angeles, Calif. The extra heavy, semi-steel cast frame and spindle arm absorb all excess vibration, permitting accurate operation to one thousandth of an inch. A unique "floating" motor mount maintains proper tension of the V-belt at all times and permits instant manual change throughout the four spindle speeds of 450, 850, 1400 and 2100 rpm.



5 A simple machine, modern in design is suitable for a wide variety of high production milling operations. Construction features a rugged cast column mounted on welded steel base providing generous clean housing for V-belt motor drive and built-in coolant reservoir (3 gal.). Standard equipment provides 12 spindle speeds by means of interchangeable V-grooved pulleys. Manufactured by Miller and Crowningshield, Dept. TJ, Greenfield, Mass.

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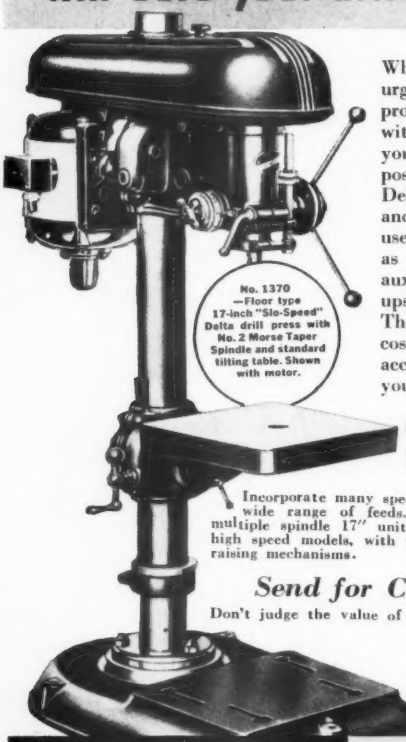

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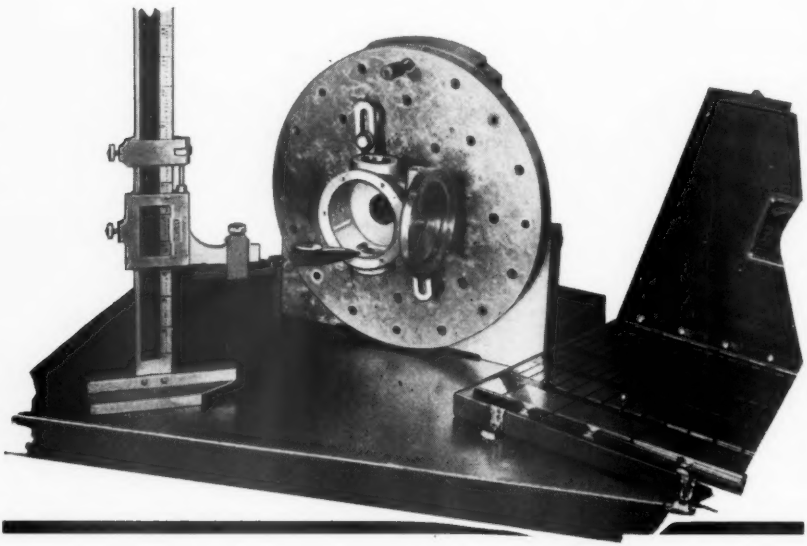

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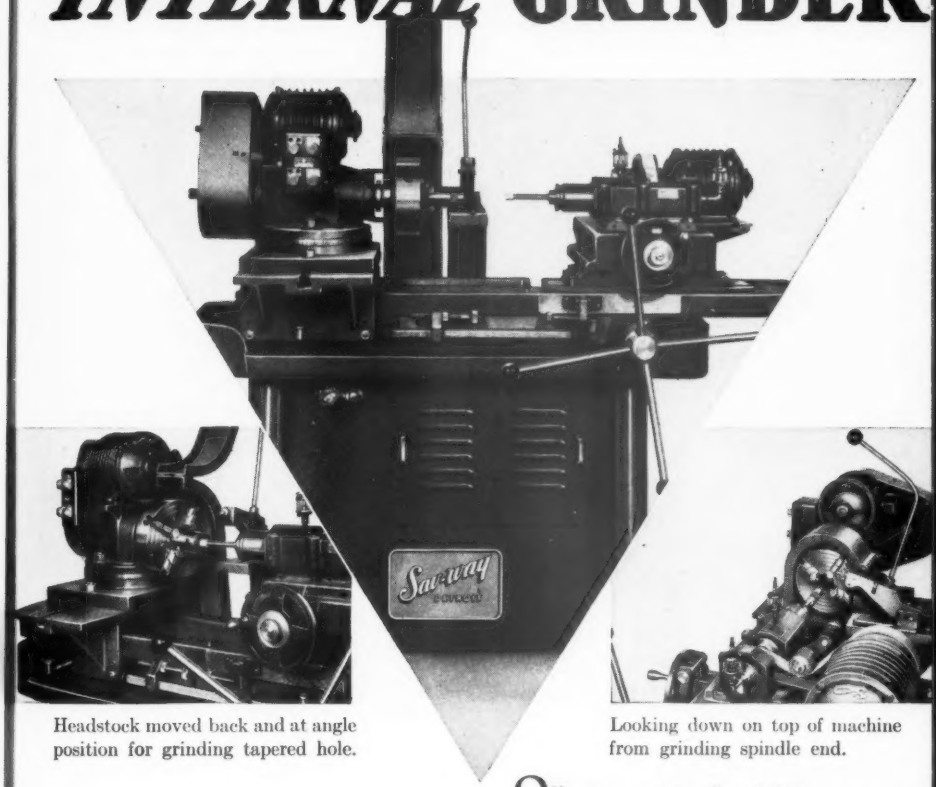

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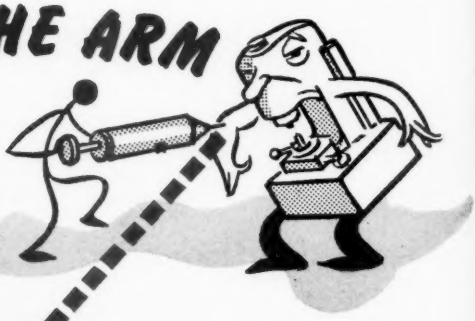

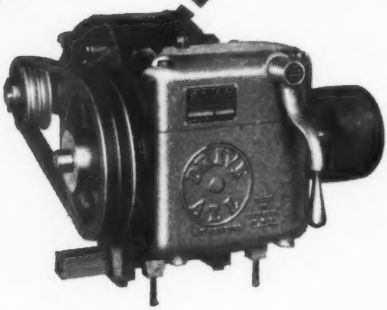

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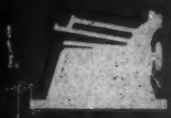

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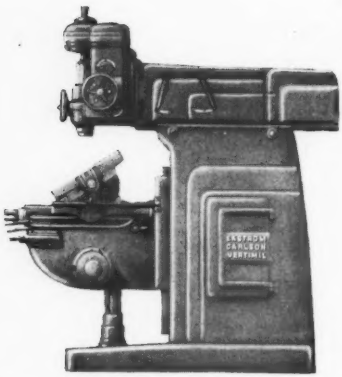

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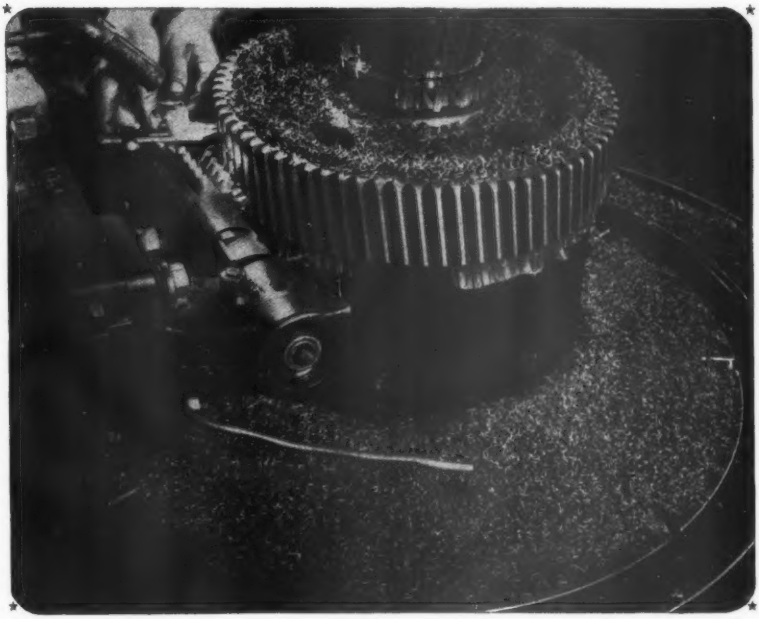
Two Sizes — 1" and 2"
Two Styles — Holding and Indexing or Holding Only

ZAGAR TOOL, INC.
23881 Lakeland Blvd. -:- Cleveland, Ohio



KEEP 'EM CUTTING . . AND SAVE THE PIECES

★ *The nation needs scrap iron and steel—millions of extra tons of it this year. Make your clean-up complete, both in the plant and at home. Subject every pound of idle metal to the searching question: "Is it absolutely essential that we keep this?"*

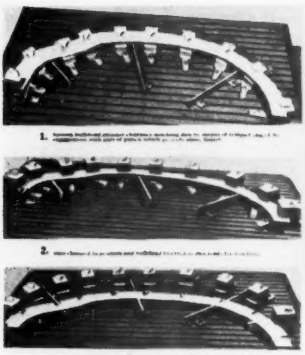
But don't stop there! Rounding up the scrap and instituting more thorough salvage methods are only part of the job of conserving the nation's resources. Start at the beginning and make better use of *new* steel . . . aim to get more finished products out of it, with less waste.

That is particularly necessary with electric-furnace steels, and the critical alloys they contain. There are many ways to save. Both stainless and tool steels can be more efficiently selected and better used, to step up production and cut down the amount of rejects and spoilage. The substitution of lower alloys, and of standard analyses, sizes or finishes instead of special ones, all offer good opportunities to save.

Right now, do your share to increase the nation's scrap stockpile. And for the duration, avoid waste in all its forms—*make every pound of steel and alloys go as far as possible.* There will be problems involved, but not insoluble ones. Call on our Technical Staff to help you.

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA

Punching and Notching Operations Stepped Up



WALES
NOTCHING DIE

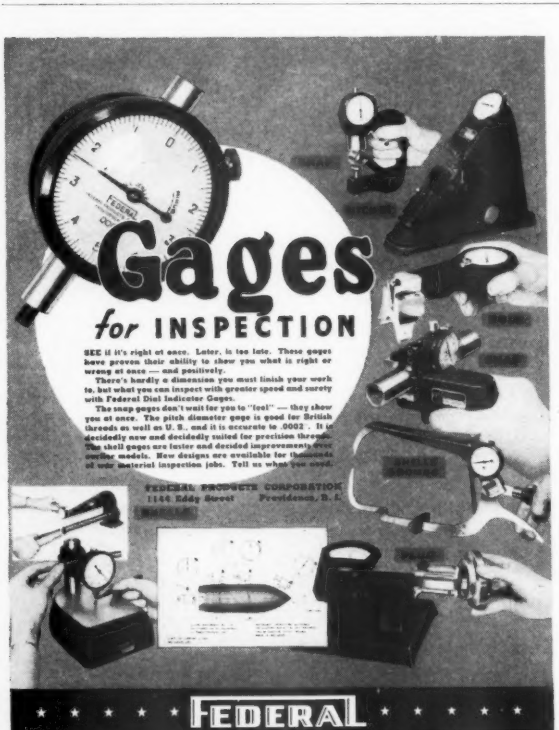
A NEW Wales Notching Unit for notching aircraft bulkhead clearances and similar notching operations has been added to the Wales line of punching and notching equipment, according to an announcement by George F. Wales, president of The Strippit Corp., Buffalo, N. Y.

This new notching unit has the same patented features as the Wales hole punching units now being used throughout the metal working industry. Nothing is attached to the press ram. A self-contained holder maintains constant punch and die alignment.

The top portion of the punch fits into notches in a templet and can be instantly removed or reset in series on rails or T-slotted plates. Wales notching units, set up in series, can be used for every size and shape of bulkhead. Standard and irregular notching patterns are notched in one stroke of the press ram.

These new Wales notching units cut clean, accurate notches, reduce die expense, provide faster tooling, minimize set-up time and increase production.

Complete information is available by writing the Strippit Corp., Buffalo, N. Y., for Bulletin BH.


Gages
for INSPECTION
SEE if it's right at once. Later, is too late. These gages have proven their ability to show you what is right or wrong at once — and positively.
There's hardly a dimension you must finish your work to, but what you can inspect with greater speed and surety with Federal Dial Indicator Gages.
The snap gages don't wait for you to "feel" — they show you at once. The pitch diameter gage is good for British threads as well as U. S., and it is accurate to .0002 . It is decidedly new and decidedly suited for precision threads. The shell gages are faster and decided improvements over earlier models. New designs are available for thousands of odd material inspection jobs. Tell us what you need.
FEDERAL PRODUCTS CORPORATION
1144 Eddy Street Providence, R. I.
FEDERAL
PRECISION MEASURING INSTRUMENTS
Chicago • Cleveland • Detroit • Hartford • Los Angeles • Milwaukee • Montreal • Moncton
New York • Philadelphia • Pittsburgh • Rochester • San Francisco • St. Louis • Toledo • Toronto • Windsor

BEHIND THE SCENES With DoAll

METAL and alloy parts cut on the DoAll Contour Machine are so smooth and clean that they are all ready for use **without further machining** or finishing. Think of the time this saves!

Then, to add to its versatility, DoAll production engineers have developed valuable **plus** equipment to handle all kinds of heavy work and jobs of irregular shapes—hydraulic work feeds, rip fences, ball-bearing work slides, work holders and guides, supports for long, heavy parts, mitering attachments for cutting tubing and channel stock at any angle, circle cutting fixtures, illuminating magnifying glasses, and others.

AIRPLANE AMBULANCES

The U. S. Air Corps has a fleet of mobile machine shops for repairing damaged planes right on the spot—the shop goes to the plane. Each "ambulance" contains a DoAll Machine as part of its essential equipment.

FOR THAT "BETWEEN MEALS" SLUMP

For the past two years, Continental has been distributing free vitamin tablets regularly to employees and since early this spring, they have also provided free drinks during the middle of each morning and afternoon. Here's a typical month's consumption:

Milk	36,755	bottles
Tomato Juice	4,575	"
Orange Juice	888	"
Total	42,218	"

It is estimated that it takes a herd of 26 cows chewing their cuds for 30 days to produce the milk. Who says Continental isn't looking out for the farmer?

KINGPIN OF SPEED CONTROLS

The Speedmaster was originally invented to provide infinitely variable speed (6 to 1 ratio) for DoAll Contour Machines. It wasn't long, however, before manufacturers of machinery in other fields discovered that this compact little unit was adaptable to their machines also. Today Speedmasters are controlling machine speeds in plants making hats, textiles, paper boxes, wire and metal products, bakery goods and even for cleaning tons of walnuts. Send for the new 40-page Handbook telling all about the many and varied applications of the Speedmaster.

● Uncle Sam tells us that every ounce of metal saved is vital right now. DoAll saves tons and tons by slicing off any metal or alloy as clean as a whistle. Makes no difference whether it's internal or external cutting, this ultra-modern production machine follows a hairline without any waste. Uncut portions of metal or alloy are usable.

Compare DoAll's economic performance with that of shapers, millers and other machines which reduce tons of metal to chips.

FASTEST METHOD TO REMOVE METAL

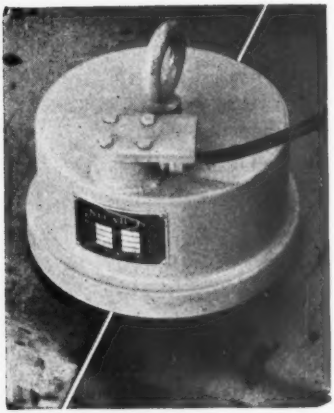
In production plants everywhere, DoAll is wrecking former time schedules—doing important sawing and filing jobs in one-half, one-quarter or one-eighth former time.

Let a factory trained man come to your plant with a DoAll and prove its metal and time saving ability to you.

A Size for Every Job . . . There is a DoAll to do your particular job faster and better. Throat capacities from 16" to 60". Priced from $1,000 to $5,000, including motors.

NEW BOOK

"DoAll on Production" shows DoAlls at work in leading plants. An interesting story told in pictures. Send for copy.



Welding Time Reduced with Holding Magnets

STEARNS electro magnets, holding magnets and magnetic welding clamps are finding numerous applications in such industries as shipbuilding and are used extensively in connection with welding operations. For example, they are used advantageously in drawing and holding plates together, a greater aid to the welding process than when the same operation is done by hand or mechanical means.

In welding, when plates are drawn together, invariably one is higher than the other. By the use of the Stearns holding magnet the plates are drawn to a level alignment with the edges brought flush against the perfect surface of the magnet. By tacking welds to the plates on either side of the magnet, the welder is able to maintain alignment — a quick, satisfactory time and labor saving solution to the problem.

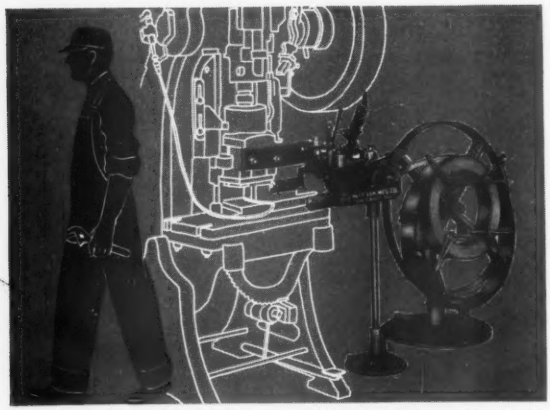
This magnet is designed in various sizes, the one shown in the illustration being of 10" diameter and weighing approximately 70 pounds, with a pull of 2,000 pounds on ¾" and 1" steel plates and operable from 40 volts or 60 volts direct current. The terminal for the energizing cable is well protected from shock and damage.

Stearns Magnetic Mfg. Co., 647 S. 28th St., Milwaukee, Wis., makers of an extensive line of magnetic separators, magnetic power transmission devices and other magnetic equipment, will send complete information upon request.

WAR PRODUCTION *rolls out faster with*

WITTEK *Automatic*

ROLL FEEDS AND REEL STANDS



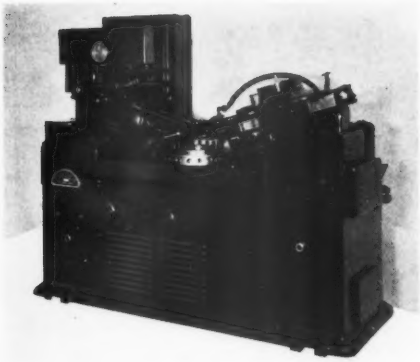
The major problem confronting industry today is increased war production. Manufacturers of metal stampings must recognize automatic feeding of coiled strip stock to punch presses as vital to the solution of their problem.

Wittek Automatic Roll Feeds and Reel Stands are designed and built by engineers with years of experience to guide them. With Wittek you can conserve man-hours and maintain new high production schedules.

✱ *Write for Descriptive Catalog*

WITTEK MANUFACTURING CO., 4305 W. 24th Pl., Chicago, Ill.

DEARBORN
Chromium Plated
gage blocks by Dearborn are chosen
by men who recognize their superi-
ority as longer wearing standards.
DEARBORN GAGE COMPANY
Originators of Chromium Plated Gage Blocks
22034 BEECH STREET • • • DEARBORN, MICH.



Production Up 700%

A PRODUCTION increase of 700% over what could normally be expected by customary tool shop methods is the achievement of this special hydraulic drilling machine which is used to drill oil holes diagonally through the trunnions of a reduction gear carrier ring.

The machine consists of three main parts—the fixture table, index mechanism and the two 2-spindle hydraulically operated drill units.

The work cycle of the machine is semi-automatic. After loading, and manually clamping the workpiece, the cycle is started and the machine proceeds through 20 indexes, completing the work.

The electrical control mechanism includes a tell-tale dial to show the operator at which part of the automatic cycle of 20 indexes the machine is operating.

In case of tool breakage, or, if an extremely dull tool is used, the machine will shut itself off automatically. This control is accomplished electrically through limit switches mounted on each spindle. After replacing the defective tool, the operator can pick up the work cycle at the point where it was interrupted and let the machine finish the part.

The time cycle for the entire operation is six minutes, giving a production increase of 700% over the previous time cycle which was 44.5 minutes.

This special machine is designed and built by Snyder Tool & Engineering Co., 3410 E. Lafayette Ave., Detroit, Mich.

Speed CARTRIDGE CASE PRODUCTION

FROM FIRST DRAW TO FINISH . . .

with TECO CARBIDE DIES

In every step in cartridge case manufacture — through drawing, sizing, tapering, necking and swaging—TECO Carbide Dies are breaking production records in America's leading ordnance plants. The controlled uniformity, density, and hardness of TECO Carbide Dies produce more draws per die, hold all on-size longer, finish smoothly and eliminate rejects. To get maximum capacity from your machines you need TECO Carbide Dies. A test run tells the story!

- DRAW DIES
- NECKING DIES
- SIZING DIES
- TAPERING DIES
- BULLET DIES
- SWAGE DIES

TUNGSTEN ELECTRIC CORPORATION
574 39th Street • • • Union City, N. J.
Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Pioneers in Tungsten Carbides for Over a Quarter Century

TECO

Two New Models in Di-Acro Line

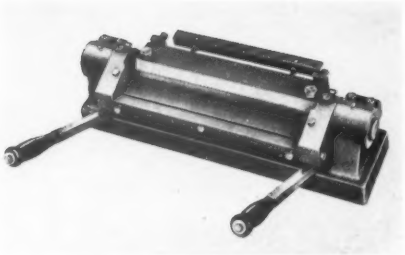
TWO recently improved models in the Di-Acro line, namely the Di-Acro Bender and the Di-Acro Brake have from 8 to 10 changes and improvements incorporated in each, including increased weight and extended mechanical strength limits, offering greater rigidity, stability, ease of operation and higher material output.

Operating range and degree of universality is also broadened, providing many additional opportunities for economical forming and duplicating without time delay and preparation expense of special dies and die sets.

Greater contact surfaces are offered as well as additional provisions for quickly removing the surfaces for changes and alterations, necessary for a wide variety of forming without dies.

Both of these units are finding wide acceptance in defense industries — the Di-Acro Bender, No. 2, being well adapted for forming round and irregular shaped tubes as well as flat materials required for aircraft and marine construction.

The Di-Acro Brake No. 2 (illustrated) is also widely used for forming various types of special materials and synthetics as well as dielectrics and other substitutes required in instrument, photographic and optical manufacture.

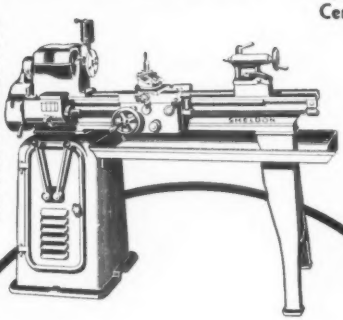


For further details and descriptive literature address O'Neil-Irwin Mfg. Co., 315 8th Ave. S., Minneapolis, Minn.

SHELDON

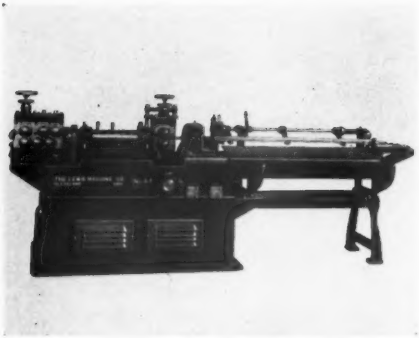
LATHE
No. U-1236 WQ
12¼" Swing, 36" Center Distance

*The Sheldon U-type underneath Motor Drive is a 4-speed V-belt drive, enclosed in the pedestal base leg. Speed changes are made instantaneously by external shift levers which operate clutches. Available with all Sheldon Lathes.



This is a quality precision lathe with large special analysis steel spindle ground all over and 1" round collet capacity. Hand scraped bronze spindle Bearings. (Also available with Ultra-Precision Ball or Super-Precision Roller spindle bearings), Full Quick-Change Gears. Double-walled Worm Feed Apron with Power Cross Feed, Heavy strutted and cross-braced semi-steel bed with hand scraped ways (2 V-ways and 2 flat ways) and U-type Lever-operated 4 speed Motor Drive.

SHELDON MACHINE CO., Inc.
4236 No. Knox Ave., CHICAGO, U.S.A.



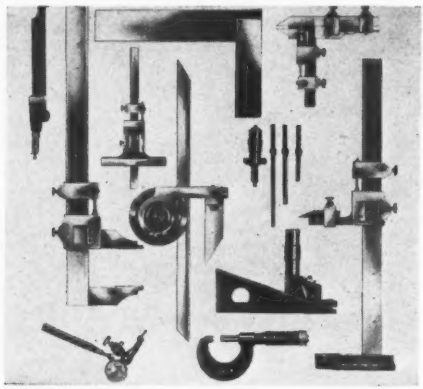
Improved Cutting

NEW in principle, the Lewis Travel-Cut combines a time-tested, proved cam cut-off mechanism with a traveling cut-off head, thus producing a simple, yet highly efficient flying shear automatic wire straightening and cutting machine.

It feeds the wire from the coil, straightens, gages to accurate lengths and cuts on the fly. A uniform diameter rod throughout the entire length, free of feed roll marks, is assured. This improved method of cutting increases the efficiency of the machine approximately 20% when cutting short lengths and is particularly adapted to precision work on bright finish steel, brass, aluminum and alloy wire.

The cut-off die is securely fastened in the traveling cut-off head. This head has vertical ways accurately machined to guide the cut-off knifeholder, and moves forward with the wire during the cutting operation. The head drive mechanism is designed to permit very low head construction—the distance from the ways to the center line of the wire being reduced to a minimum. An exceptionally long bearing surface eliminates any tendency to rock at the end of the stroke or produce uneven wear on the head or bed ways. The head ways are completely enclosed and lubricated by a forced feed pressure oiling system which floats the head during its entire stroke.

Send for Bulletin No. 536-A. Address The Lewis Machine Company, 3441 E. 76 St., Cleveland, O.



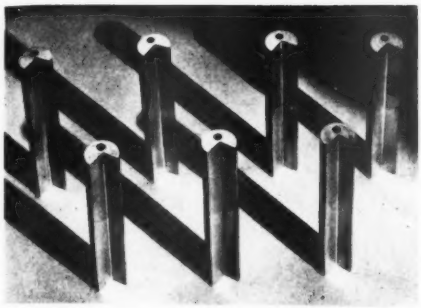
STARRETT TOOLS are undertaking an important share of the responsibility for the superiority of American war machines. On countless precision measuring and inspecting operations they contribute to speed of production and conservation of materials as well as accuracy. They enjoy the confidence of the men who work with them.

While exerting every effort to meet the extreme demand for precision tools, The L. S. Starrett Company intends to maintain the standards for accuracy and workmanship that users of Starrett tools have learned to count upon for the past 60 years.

THE L. S. STARRETT CO., Athol, Massachusetts, U. S. A.
World's Greatest Toolmakers

STARRETT
PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Carboloy Tipped Rifle Drills for .30 and .50 Calibre and 20 mm Gun Barrels



WITH completion of experimental production runs resulting in an increase of ⅓ to ½ in output of drilled gun barrels per man-hour and machine-hour, Carboloy tipped rifle drills for .30 and .50 caliber and 20 mm gun barrels have been placed in production.

The new gun drills are to be furnished with the Carboloy tip brazed to a short steel shank which in turn is attached by the users to their regular gun drill tubes. Cutting edges are not finish ground, since optimum angles vary among different plants depending on particular machining conditions, materials to be cut, etc.

There is less tendency for Carboloy drills to seize or "fuse" in gun barrels than is the case with steel drills. This development also insures minimum of wear on the drill tip.

Production experience to date indicates an average of some two dozen .50 caliber barrels per grind of the tip, with an average of 12 to 18 barrels per drill produced per shift. This compares with an average of one barrel per grind with HSS drills. Carbide drill life is increased as only .010" per grind is removed, compared with an average of .030" for steel drills. Reduced downtime for changing drills results and increased production is obtained.

Further information furnished upon request. Address Carboloy Co., Inc., 11191 E. 8 Mile R., Detroit, Mich.

TWO MACHINES IN ONE!

For Die-Filing Use Top Table in Position Shown.

For Punch or Blind-Hole Filing Tilt Top Table Back, Use Lower Table.

DIE TABLE Filing From Below

PUNCH TABLE Filing From Above

No more hand filing of intricate jobs or inaccessible parts! With this universal machine you can take care of all filing and lapping jobs as they come along. Stroke fully adjustable from 0 to 1½". Two Speeds. Fully enclosed motor. Ball Bearings throughout. No dripping of oil. No waste of unused file sections.

Write for Descriptive Circular.

MARBURG BROTHERS, INC.
Exclusive Distributors
90 West Street New York, N. Y.

SHOP AIDS

"KEEP 'EM RUNNING"—is the title of a booklet recently announced by The Rotor Tool Co. as one phase of a Tool Conservation Plan. The Plan is a well worked out approach to the entire problem of maintenance and conservation of high cycle electric and air portable tools.

The illustration, taken from the booklet, shows the cartoon type method employed to

emphasize important points. Besides the booklet other important parts of this Plan include: a poster emphasizing the importance of the general subject; factory trained service men to answer questions; detailed repair parts sheets furnished as well as recommendations made as to the lack of equipment, etc., to really do the job. The Rotor Tool Co., 17329 Euclid Ave., Cleveland, O., will furnish full details upon request.

SHEET METAL PATTERN DRAFTING—Throughout this book, special attention is given to the fundamentals that underlie the current methods of sheet metal pattern drafting. Practical shop problems in sheet metal drafting of the kind that occur in everyday practice are discussed.

The first part of the book covers the parallel forms—prisms and cylinders. The second part, the radial line method—forms conical in shape. The last part deals with the triangulation method—all kinds of irregular forms. Many line drawings make for clearness and easy understanding of the text. Written by Frank J. O'Rourke. Price $2.00.

COMPUTATIONS FOR SHEET METAL WORKING OPERATIONS—In the working of metal in mechanical power presses it is often desirable or necessary to compute the pressure capacity and sustained work capacity of the press as well as the pressure and work requirements of the job which the press is to do. This 52-page book contains a series of alignment diagrams for ease in making these computations. The subjects covered are: blanking and shearing; drawing and reducing; ironing; coining, sizing and forging; and mechanical press selection. Those interested in securing this valuable book write E. W. Bliss Co., 53 St. and Second Ave., Dept. B8, Brooklyn, N. Y.

GENERAL TRADE MATHEMATICS—This book was written for student consumption. Beginning with the most fundamental mathematics each chapter builds on the information contained in previous chapters. There are more than 150 practical topics explained with boxed examples for easy reference. Supplementing these topics there are over 3000 exercises and problems selected from shop situations. This book is excellent as a text book for industrial and technical schools or for home study and reference work. Written by E. P. Van Leuven, B.S. Price $3.50.

Safety Factor Stressed on New Press

A NEW, highly versatile oil hydraulic press, offered in capacities of 50 ton and up, has just been announced by The Denison Engineering Company. It supplements the applications and wide range of tonnage capacities previously offered by this company's line of small capacity presses. It is adapted to a wide range of straightening, assembling and pressing operations in either small lot or production work.

This press is of rugged construction, self-contained, streamlined and safer to operate. The safety factor has also been considered in the location of controls and the press ram is threaded internally for attaching, assembling, bending or straightening tools.

The DLOS2 Press is furnished with hand-lever or electrical controls, located in the base of the press. The control is arranged so that tonnage applied to the work is controlled within reasonable limits by the operator.

To operate, the control lever is pushed down. This causes the ram to move downward at rapid traverse speed until it contacts the work, exerting a minimum of tonnage. When the control lever is released, the ram moves upward until the upper "stroke stop" on the shipper rod is reached, moving the control valve to the neutral position. The pump and motor idle, consuming a minimum of hp and the ram is held in place "hydroilically."

To obtain additional information write Denison Engineering Co., Dept. D-5, Columbus, Ohio.

The Jackson No. 2 Verticle Milling Machine, ruggedly built of quality materials, will prove indispensable for Tool Room or Production applications. 5 speed V-belt drive, sturdy 4¼" quill and ¾" spindle capacity 8" x 32" table.

JACKSON
MACHINE & TOOL COMPANY SALES DIVISION
956 Roberts St. Jackson, Michigan

Molded Plastics

(Continued from Page 57)

by increased speed per hole and by increased number of holes per grind. The latter factor increases the life of the drill considerably. The production foreman may well invest his time in teaching his operators how to grind their drills properly.

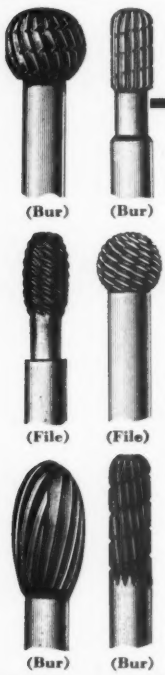
Drilling speeds and feeds for plastics materials should be high. The drill should make the cut quickly and sharply and then move away immediately in order to avoid overheating. For thermosetting materials, the top speed of a properly ground drill may be just short of that which will cause burning. For thermoplastics, the top speed is determined by the individual material and it should be below that speed which will cause seizing. For small drills, recommended speeds are from 3000 to 5000 rpm.

Tapping

Tapping is an operation which is extensively performed in plastics finishing. Threads are tapped directly in cored or drilled holes in the moldings. Often threaded inserts which are molded in place have to be rechased to size when molding pressure has squeezed them out-of-round or undersize, or when flash has run down the threads.

Generally, two types of tapping mechanisms are used. In one type of mechanism, axial pressure on the tap forces it against one or the other of opposite directional drivers. The forward drive is engaged when the tap is pushed into the hole and the reverse drive is engaged when the tap is pulled out of the hole. In the other type of mechanism reversing motors are used and the reversing is accomplished by means of limit switches which may be set to trip when the work has fed into the desired depth. The first type of mechanism is well suited to tapping one hole at a time where the work may be held in the hand and fed to the tap or held in a fixture on the table and the tap fed to the work. The second type of mechanism is well suited for multiple tapping applications in fixtures which feed the work into the taps.

Thermosetting materials act like cast iron in that the chips are powdery and the finish of the threads is porous.



MARTINDALE ROTARY FILES and BURS

Made from High Carbon Steel or High Speed Steel these accurately cut Files and Burs are available in 300 sizes.

Orders are usually shipped within 6 days after being received.

Write for 12-page Bur Bulletin.

THE MARTINDALE ELECTRIC CO.

1417 Hird Ave.

CLEVELAND, OHIO

Thermoplastics are possibly more difficult to tap because the material tends to seize and tear with resultant rough threads. Thermosetting materials are abrasive because the resin itself is hard and the filler may be an abrasive material. Thermoplastics, unless they are filled, are not abrasive, but slight tap wear produces enough dulling to cause poor threading due to roughness and overheating.

Chromium plating is recommended for taps used in plastics. A coating of .0002" is sufficient to increase the number of holes per grind about 100%. The chromium is hard and resists abrasion and dulling better than the steel alone.

Taps with narrow lands behind the cutting edge are somewhat better than those with wide lands because there is less chance for frictional heat. Two- or three-flute taps are usually used. Speeds for tapping vary up to about 50 fpm. Feed, of course, depends upon the lead of the screw.

Tap drills usually cut slightly undersize in plastics materials. For this reason, the drills should be selected one or two numbers larger than those recommended for steel. This amounts to about .003" to .005" on the diameter. If the thread is not subjected to very much service, sometimes even more allowance may be made in increasing the tap drill diameter in the interest of faster tapping. This is not good practice by any means, but for highly competitive low-grade articles it may mean the difference between profit and loss.

Production rates for tapping operations vary from 100 per hour for single holes in difficult holding fixtures, through 800 cycles per hour for simple fixtures in multiple spindle machines and up to 1200 per hour for single holes in hand-held work or in rechasing threaded inserts.

Fixtures for tapping should allow the taps to locate themselves in the holes and merely support the work in proper alignment so the taps run in straight. A considerable amount of responsibility in preventing breakage rests upon the tapping operator, especially in using multiple tapping machines. The design of tapping fixtures may well include consideration of the operator and his experience.

MAKE-ALL RADIUS DRESSER

You will prefer the MAKE-ALL for simplified *Concave and Convex Radius Dressing* because it is so easy to operate. Feature of the Make-All is simplicity of design that results in an unusual degree of accuracy for a radius dresser requiring no difficult calculations, depth gauges, micrometer or vernier setting. Send priority rating with your order for prompt delivery.

ATTACHMENT FOR FULL SEMI-CIRCULAR RADII

A special attachment accurately made, which with the use of Rattail Diamond Tools, will make full semi-circular radii as small as 0.035". Available at small additional cost.

$62.50 MAKE-ALL with one 60° GOLCONE Diamond Tool.

$72.50 MAKE-ALL with 60° GOLCONE, semi-circular radii attachment and Rattail Tool for 0.070" or larger radius.

Distributed by

Golconda Diamond Products Corp.

3856-58 NORTH ASHLAND AVENUE • CHICAGO, ILL.

Turning and Boring

Some work in the plastics finishing department calls for precision machining. Undercuts, for example, may be more convenient to machine than to mold. Sometimes greater precision is required of a finished piece than can be expected to be produced by the mold alone. Precision engine lathes and carbide or diamond tools are often used to produce fine fits for plastics parts which are allowed to season for a few days or more before machining until shrinkage stresses are stabilized.

Lathes and other machine tools for machining plastics should have high speeds available such as are used for cutting brass. Thermosetting materials can be machined satisfactorily without using a coolant. This applies to thermoplastics as well, but a better practice is to use a coolant if the machine can be set up for it. Water with a small amount of soluble oil is satisfactory. The oil helps prevent rusting and does not necessarily have much effect upon the cutting action.

Large production warrants the use of specially designed holding fixtures rather than the use of standard chucks and collets. Special fixtures may save from a few seconds to a half minute or more per cycle. Accuracy limits for machined plastics may be .0005". This requires the machines and fixtures to be in good condition.

Broaching

Irregular holes in molded plastics or in integrally molded inserts are not uncommon in the finishing department. It is convenient and sometimes necessary to remove flash from or to size such holes with broaching tools. Hydraulic and foot-operated broaching machines are applicable. Often a foot press is faster than the hydraulic machine for small work. Heavy jobs should be put in the hydraulic machines to avoid fatiguing the operator.

For fast cycles, a push broach may be arranged to push clear through the work and fall into a trough which returns the broach to the front of the bench. The operator retrieves the broach with one hand and reaches for another molding with the other. At the same time the broaching head is returning to position to begin the next stroke.

We deliver the goods!

DOWEL PINS

IN STOCK FOR IMMEDIATE SHIPMENT

● Yes, sir . . . Die-Co hardened and ground Dowel Pins are *carried in stock* for your convenience. Ground to tolerance of plus or minus .0001". Standard pins ground .0002" over listed diameters; over-size pins ground .001" over listed diameters. In 38 lengths, from 3/8" to 6". In all diameters, from 1/8" to 1".

●

We can fill your requirements for all Die Maker's supplies, including a complete line of Springs in three standard types, and the amazing Hardsteel Drills that enable you to drill hardened steel without annealing.

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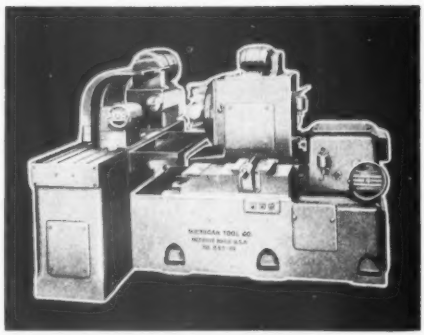
Write for illustrated Catalog showing these and many other items.

DIE SUPPLY CO.

J. R. Fitzsimmons W. H. Fitzsimmons Jos. T. Fitzsimmons

4751 Hough Ave., CLEVELAND, O., EXpress 1133

Flexibility is Keynote of New Heavy Duty Machines



AN entirely new series of heavy duty machines for finishing gears used in speed reducers, machinery of various types, large engines, turbines, etc., has been announced by Michigan Tool Co.

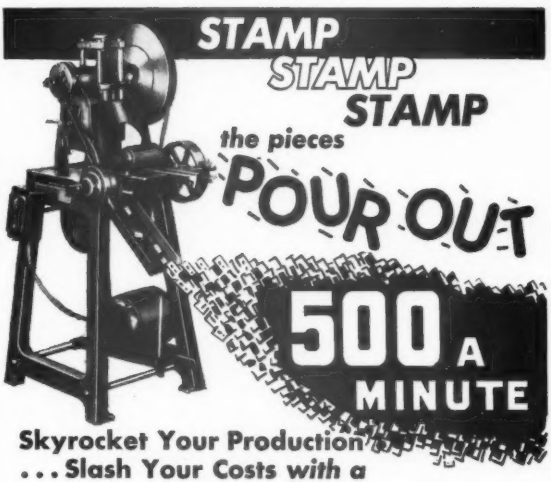
The application of the crossed-axis principle of gear finishing to a wide range of gear sizes is possible due to the flexibility of these machines. The flexibility of the Series 862 machines also permits selection of the most desirable method of finishing for any specific gear type, taking into consideration the face width, diameter and shaft length of the gears to be finished.

In all methods, the work drives the meshing cutter. The first method is particularly suited to finishing wide face gears. The cutter has an infeed toward the gear and is reciprocated parallel to the axis of the gear. This is accomplished by placing the slide, which carries the cutter head, in a horizontal position.

In the second method the slide is set vertically. This method is used for quick finishing of gears having a narrower face width than the cutter and for close shoulder work.

The third method represents a combination of the first and second methods. The cutter slide is again vertical but infeed is used.

Michigan Tool Co., 7169 E. McNichols Rd., Detroit, Mich., will send further details at your request.



Skyrocket Your Production
. . . Slash Your Costs with a

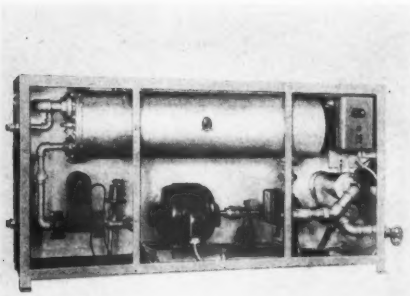
DIEBEL Hi-Speed PRESS

Absolute safety for men or women operators—controlled high speeds—automatic operation—these and other exclusive Diebel Press features add up to highest stamping production, lowest operating costs. A vital necessity today.

WRITE FOR BULLETIN . . .

DI MACHINE CORP.
DIVISION OF DIEBEL DIE & MFG. CO.
3653 N. LINCOLN AVE. CHICAGO

B&G Rapid Oil Cooler Assures Uniform Bath Temperature



THE most effective use of the oil quenching bath calls for controlled cooling of the oil. For this purpose the B&G Rapid Oil Cooler offers a method which is efficient, economical and assures a uniform bath temperature at all times. City water, under accurately controlled conditions, is utilized to cool quenching oil and maintain the quench tank constantly at the desired degree.

The generous heat-transfer surfaces built into these oil coolers assure rapid exchange of heat from the oil to the circulating water. This means that large capacity is obtained in comparatively small units.

Large capacity oil coolers are an assembly of straight copper tubes encased in a steel shell. Oil circulates through the tubes where it is cooled by water passing through the shell. By simply removing the head of the unit, the tubes are exposed for easy cleaning.

In the smaller models, in which the tubes are coiled, the oil is circulated through the shell and the cooling water through the coils. Thus, the tubes do not become fouled and sludge is easily cleaned from the bottom of the shell.

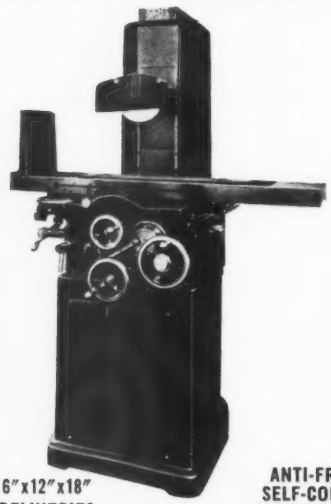
The B & G self-contained oil cooler (illustrated) is especially designed for manufacturers whose heat treating volume is comparatively small.

Bell & Gossett Co., Dept. 27, Morton Grove, Ill., will send illustrated literature at your request.

ATLANTIC

No. 2 Automatic Precision Type

SURFACE GRINDER



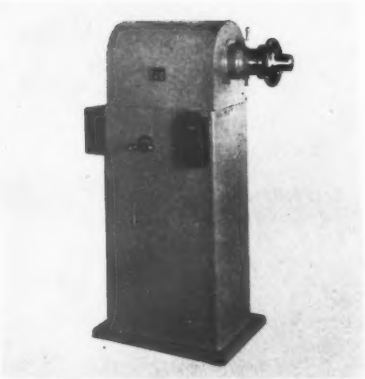
CAPACITY 6"x12"x18"
PROMPT DELIVERIES

ANTI-FRICTION
SELF-CONTAINED
POPE-SKF SPINDLE

ATLANTIC MACHINERY CORP.

149 Broadway New York, N. Y.

Lathe Increases Output



THIS Ideal Speed Lathe is especially designed to increase the output of finished screw machined parts up to 1⅜" in diameter. The Sjogren Chuck operates a spring type collet which is quickly adjusted to the size of the work by means of a hand wheel mounted on the chuck. The hand wheel is deeply grooved for quick, easy opening and closing of the collet.

The machine is similar to the Schauer Standard Variable Speed Lathes. Motor speeds ranging from 20 rpm to 4,000 rpm are available. The speeds are in ratio of 6 to 1 for single speed motors and 12 to 1 for two speed motors. Variation in spindle speeds is obtained by movement of a variable pitch pulley controlled by a conveniently located ball crank.

Standard size pulleys are used and connection between driving and driven parts is by means of replaceable standard length V belts. Tension adjustment for both belts compensates for wear and stretch.

The motor is spring mounted in the base of the pedestal and automatically controls belt tension. The motor and brake are controlled by hand.

Operations which can be performed on this Ideal Speed Lathe are: finishing; burring; filing; lapping and polishing.

All additional information can be secured by writing the manufacturer — Schauer Machine Co., 2076 Reading Rd., Cincinnati, O.

Eliminates Costly Hobbing

No. 5 Case History

An internal gear had to be cut in the bottom of a cavity in a block of steel. After the preliminary machining operations had been performed, the block was chucked on a dividing head mounted on the table of a milling machine. . . . A special form tool and tool holder was inserted in the clapper-box of the "SLOTMASTER". . . . With this set-up the job was done quickly, cleanly and accurately eliminating several costly hobbing and hand operations.

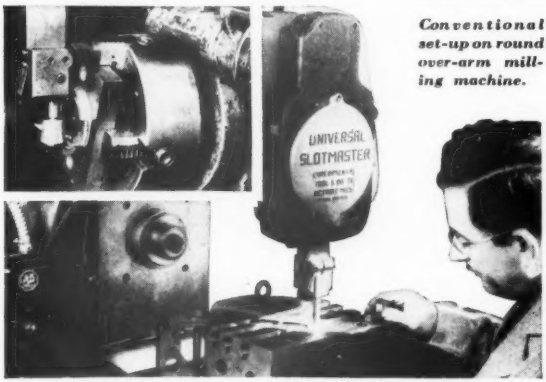
Thumbnail Illustration shows set-up

SLOTMASTER can be used on milling machines and provides double duty facilities at a minimum cost. It requires but little time to change-over from one head to the other . . . The stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 s. p. m. . . . The tool holder, of the clapper box type, can be turned in any position . . . All of the working parts are of tool steel heat treated and ground to close tolerances . . . SLOTMASTER comes complete with pulleys, motor, belt and mounting adaptable to round over-arm or flat-on-round over-arm milling machines.

Send for 4-page catalog and give the specifications of the milling machines that you wish to equip. Immediate deliveries on high priorities.

EXPERIMENTAL TOOL & DIE CO.

12609 GREINER DETROIT, MICH.



Conventional set-up on round over-arm milling machine.

Die Head Gives Trouble-free Service

MODERN Stationary Type Self-Opening Die Heads, it is said, are accurate in cutting, durable in service, positive in opening and adapted to practically every thread cutting operation within their capacity. They can be used on screw machines, turret lathes and other machines in a stationary position.

The Style T Die Head, here illustrated, consists of four major parts—die head body, cam ring, adjusting ring and shank. The die head body carries four chaser plates to which the chasers are rigidly fastened by screws. Chasers are brought into cutting position by turning cam ring and locked in position by double feather on the shank. When thread cutting is finished and the die head advance is stopped or retarded, the lead of the thread being cut draws the die head proper away from the shank and locking feathers, thus releasing the die head body which opens the chaser from the work. This action is simple and positive.

An important feature is the exceptionally wide range of threads that can be handled. With three Style T Die Heads, threads from ⅛" to 2" can be cut. An attachment for cutting extra long taper threads is also available.

For complete information regarding the entire line of Modern Precision Tools, write Modern Tool Works, Dept. J-8, Rochester, N. Y.

DOUGLAS

PLAIN MILLER

FOR SMALL PARTS PRODUCTION

WIDE RANGE OF SPINDLE SPEEDS from 75 to 1200 R.P.M.

TABLE SIZE 32" x 8"

QUICK DELIVERY BY LARGE SCALE PRODUCTION

DOUGLAS MACHINERY CO. INC.

150 BROADWAY NEW YORK, N. Y.

Vertical Milling Machine for Small Dies, Jigs and Fixtures

THE Linley High Speed Vertical Milling Machine and Jig Borer is unsurpassed, it is said, for small dies, jigs, fixtures, model work, molds for plastics, metal patterns and all types of drilling, milling and boring operations.

Recent improvements incorporated into the machine increased the table size to 7" x 17½" with three T slots instead of one. The longitudinal travel has been increased to 10" and the cross travel to 6", both without running out of the ways. The maximum distance from the table top to spindle nose has been increased from 9" to 11½". The column ways have been shortened at the lower end, allowing more clearance for fixtures, etc., on the table.

The micrometer screw feed head is counterbalanced by the use of a weight of the correct size. The quill is counterbalanced by the same weight through a compound lever to remove any backlash.

A depth stop gage located in front of the quill is graduated with ten lines to the inch. One turn of the hand wheel (.100") equals one space or one tenth inch on this gage. This is an entirely new measuring device and work can be accurately machined to predetermined depths without any pencil figuring—thus eliminating the possibility of errors.

Descriptive literature is available upon request. Write Linley Brothers Co., 14 Montauk St., Bridgeport, Conn.

CONSERVE DIAMONDS!
DRESS YOUR GRINDING WHEELS WITH THIS DRESSER!

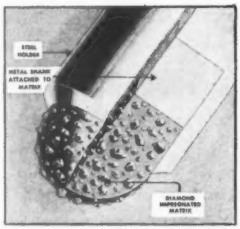
Save diamonds by using Carboloy Diamond - Impregnated wheel dressers. Instead of large costly stones these dressers contain a large number of sharp-pointed diamond particles firmly embedded in a special matrix.

No remountings are necessary as the diamonds are permanently held throughout a long useful life. A quarter turn of dresser in holder presents a new cutting surface.

Available in 3 sizes, each suitable for rough, semi-finish and finish dressing operations.

Send for Catalog DR-100

CARBOLOY COMPANY, INC.
11107 E. 8 Mile Rd., Detroit, Mich.
Chicago, Cleveland, Los Angeles, Newark, Philadelphia, Seattle, Pittsburgh, Worcester, Mass.



View showing quarter section of dresser.

CARBOLOY CEMENTED CARBIDES
TOOLS · DIES · DRESSERS
CORE BITS · MASONRY DRILLS
· WEAR RESISTANT PARTS ·
FOR THE MANUFACTURING · MINING · TRANSPORTATION · CONSTRUCTION INDUSTRIES

Low Temperature Melting Alloy for Molds and Dies

THE need for a low temperature melting metal, which may be used to accurately proof-cast cavities such as molds, gun chambers, forging dies, etc., has been adequately met by the use of Cerrosafe, according to J. R. Fitzsimmons, Manager of Die Supply Company, Cleveland. Many materials have been used for this purpose but were found objectionable because they were fragile, had excessive shrinkage or the casting temperature was sufficiently high to cause inaccuracies due to thermal expansion and distortion of parts surrounding the cavity. Cerrosafe has none of these disadvantages.

Cerrosafe is a mixture of bismuth, lead, tin and cadmium. It weighs approximately .35 lbs./cu. in. and is completely molten at 190 F. The pouring temperature should be as low as possible but sufficient to allow the cavity to be filled before the alloy solidifies. Overheating the alloy prolongs the cooling time and is likely to distort the parts surrounding the cavity.

Cerrosafe should be melted in a clean iron ladle. The source of heat should be removed the instant the alloy is completely melted. It can then be poured.

The casting should be removed from the cavity or mold before or when it cools to room temperature. If allowed to remain in the mold too long, the casting may be gripped in the mold. Should this happen, melt the alloy by placing the mold in boiling water. In some cases, it is advisable to coat the surface of the cavity or pattern with lamp black or graphite before casting the alloy.

Die Supply Co., who recently moved to their new address at 4751 Hough Ave., Cleveland, O., will furnish full particulars on Cerrosafe Metal on request.

Suttonizing

—the new process for conserving critical tooling steel in the salvaging of worn and broken cutting tools. *See page 38.*

JOHNSON
FURNACES
READY TO FIRE!

No. 130 Speeds Heat-Treating

2300° F. in 22 Minutes

Most economical for speedy heat-treating of hi-speed steels.—for hardening punches, dies and tools. 4 Johnson burners produce quick, accurate high temperatures. Equipped with G. E. motor and Johnson blower. $248 F.O.B. Factory. Two weeks delivery on orders carrying A1-J or better priority rating.

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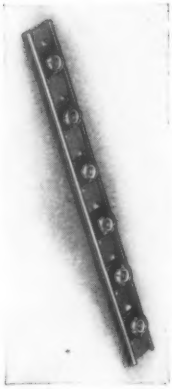
JOHNSON FURNACES for INDUSTRY
FOR MORE THAN 40 YEARS

JOHNSON GAS APPLIANCE CO.
560 E. Ave., N. W.
Cedar Rapids, Iowa

Multiple Self-Locking Fastening Available



ELASTIC Stop Gang Channel Nuts, widely applied in the aircraft industry, are now offered for testing on the many applications in general industry where a multiple, self-locking, bolted fastening is required.

The strips are factory-assembled, and it is necessary only to rivet or otherwise fasten them to the structure where they are to be used. These nuts are especially designed with four lugs at the base and installed at specified intervals in a metal channel strip which is preformed to accommodate the nut lugs under longitudinal flanges. The channel strip is pierced for the required nut size and spacing and the nuts are held in place by dimples in the channel.

In application, the assembled gang channel is permanently attached to the structure with bolt holes aligned with those in the structure. As in all Elastic Stop Nuts, the locking action is obtained with a vulcanized red fiber collar which resists the entry of the bolt. This action forces the nut outward, creating a constant metal-to-metal pressure-contact throughout the threads of nut and bolt; taking up all axial play and creating a cushion against vibration stresses and impact.

Elastic Stop Nut Corp., Vauxhall Rd., Union, N. J., will send further details at your request.

Use Them Over and Over

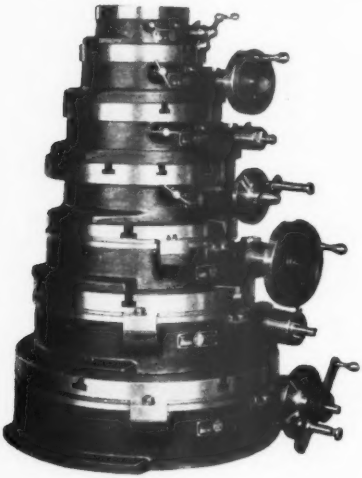
DE-STA-CO ARBOR SPACERS

Measured by the number of times they can be used, De-Sta-Co Spacers are the lowest in cost of any spacers you can buy. Made of metal, they are not affected by oil or heat. Use these spacers for quick set-up of milling machine cutters and wherever low cost, accurate spacing is required.

Stock sizes .001″ to .125″ thick. Specials, any length, cut from bar stock, ground to decimal.

TRIAL ASSORTMENT—enough for average use on one machine sent for $1.00. Give arbor size. *Size and price list sent* FREE!

DETROIT STAMPING CO.
Established Over 25 Years
344 Midland Ave • Detroit, Mich.



Rotary Table for Many Types of Work

THE rotary table is a useful addition to any shop doing a variety of work. It is used for a wide range of work on milling machines, shapers, drill presses and horizontal boring mills. A rotary table will, in a great many instances, take the place of a costly fixture.

The illustration shows the selection of sizes offered. With the exception of the Model BH-9, all tables are so designed that the dividing attachment may be purchased at any time after the table is in use. This attachment is interchangeable on table of three sizes.

On the heavy duty models the worm may be easily disengaged and again engaged without affecting the adjustment between the worm and the worm-wheel. The worm shaft runs in bronze bushings.

The heavy work for which these tables are used calls for a positive lock between platen and base. The platen revolves on a full diameter track and on a stem running in a tapered, split, adjustable bushing. Wear on the track is adjusted by means of a thrust nut on the end of the stem. The graduations on the platen (in degrees) and on the dial (in minutes) are cut on a special graduating machine to assure accuracy. Materials used are all carefully selected, the castings being made of high grade semi-steel nickel iron.

Additional information will be supplied on request. Write Alfred A. Troyke, 4421 Appleton St., Oakley, Cincinnati, Ohio.

FLOATING HOLDERS for Screw Machines

•

Now Available for
IMMEDIATE DELIVERY
(In Stock)

B & S No. 00 - - -	$6.00
B & S No. 10 - - -	6.25
B & S No. 12 - - -	7.95
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Made of a new Special Alloy
as developed by our Engineers

(Designers and Builders of Fine Machine Tools)

AJAX ENGINEERING & MFG. CO.
MANUFACTURERS OF HALCO PRODUCTS
14230 BIRWOOD AVE., DETROIT, MICH.

Engine Lathe Tool Holder Developed by Lane-Wells

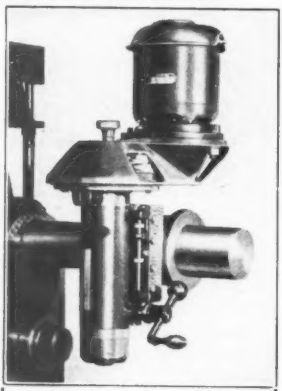
A SIMPLE, rugged engine lathe tool holder that cuts tool changing time to approximately five seconds and greatly reduces operating time has been developed by the Lane-Wells Co.

Known as the Lane-Wells Universal Tool Holder, the device consists of a tool post which can be fitted on to any engine lathe carriage compound rest. The detachable heads fit into a cylindrical member which is clamped into the tool post. Standard high speed tool bits used for boring, turning, threading, facing or forming are fastened into the heads. Drills and reamers can also be used.

In practice the lathe operator has several heads, each carrying a tool to perform a certain operation on the stock. The first head is locked in place in the tool holder by a quarter turn of the control handle. As soon as the operation on the stock is performed by the first tool, the operator releases the head, replaces it with the second head, locks it in place and is ready for the next operation. The change requires approximately five seconds. After sizes are once established all readings can be taken from the cross feed dials.

If a particular tool must be removed and then reinserted in the tool holder it can be reinserted in exactly the same position it originally occupied.

Complete details and specifications are available from Lane-Wells Co., 5616 S. Soto St., Los Angeles, Calif.



Five speeds 350 to 2900 R. P. M. Also 10 speeds 125 to 2900 R. P. M. available at extra cost.

The Halco Hi-Speed Universal Milling Attachment has proven its importance in building tools, dies, jigs, fixtures, wood and metal patterns and other machine products. Its 4-inch vertical travel permits many milling, boring and facing operations in one setup, a factor of convenience to which is added the advatage that the unit can be easily mounted by one man, it weighing only 90 pounds. Each head is unconditionally guaranteed for six months.

IMMEDIATE DELIVERY

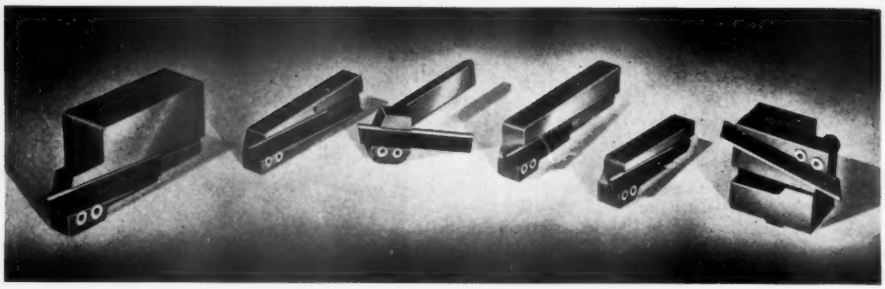
(Designers and Builders of Fine Machine Tools)

SEND TODAY FOR FOLDER

AJAX ENGINEERING & MFG. CO.

MANUFACTURERS OF HALCO PRODUCTS

14230 BIRWOOD AVE., DETROIT, MICH.



Ease and Speed Are Features of New Tool Holder

SIX new tool holders designed for the accommodation of the Luers Patented Cutting-Off Blades on six additional types of screw machines were recently announced.

The development of these holders now broadens the use of Luers Blades, already extensive, to include their adaptability on the following makes of machines: Greenlee 4- and 6-spindle Automatics, New Britain Automatics, all lathe and hand screw machines with round posts, Acme-Gridley R and RA Series, and Gridley Models F and G Multiple Spindle Automatics.

One of the many outstanding features of the holders is the ease and speed with which a cutting-off tool can be set up in the machine and the facility with which an operator can remove the blade for resharpening and later replace it precisely in the original position without disturbing the set-up.

The Luers Blade is held in place as securely and rigidly as any forged blade by means of two unique cams which force the top surface of the blade against the ground surface of the holder and provide a solid bearing.

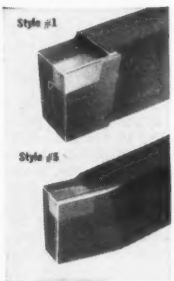
Write Empire Tool Co., 8780 Grinnell Ave., Detroit, Mich., for complete details.

Reduce YOUR SERVICE COSTS BY USING KENNAMETAL*

• KENNAMETAL, because of its strength, hardness and crater-resistance, machines more steel per tool grind than does any other tool material. That means fewer shutdowns of machines, less time spent in grinding tools and smaller tool inventories.

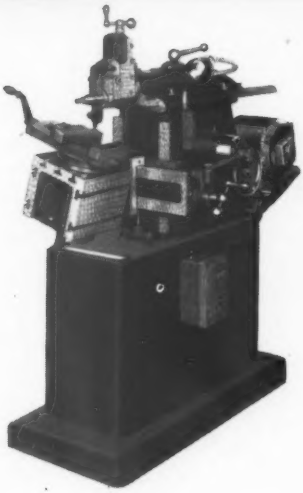
In these days of high production, it costs you money every time you shut down a machine. Save that time and money by using only KENNAMETAL to machine your steel parts. Write for the KENNAMETAL Vest Pocket Manual, containing complete details.

*INVENTED AND MANUFACTURED IN U.S.A.



McKENNA METALS Co.
500 LLOYD AVENUE, LATROBE, PENNA.
Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
Exclusive of Canada and Great Britain

Perfect Balance at High Speed Assured



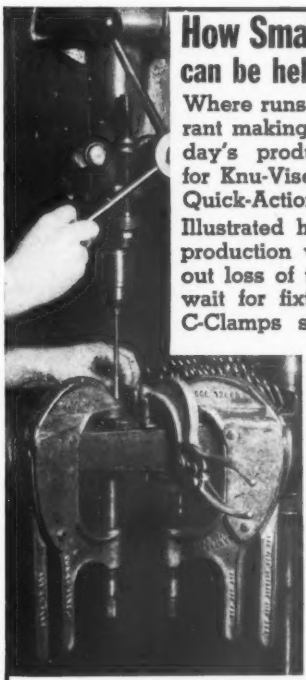
THE Hy-Duty Shape-Rite shaper, designed and built to handle any class of work within an eight-inch stroke capacity, has working surfaces ground and hand scraped. Each part is closely fitted to insure positive accuracy and longer life. To relieve strain and to increase the life of the shaper, all of the castings are made of special alloy.

These shapers are furnished with precision cut helical gears mounted on anti-friction bearings. A hand wheel, mounted on the end of the drive shaft, makes it easier for the operator to adjust and set the tool.

The ways on the front of the column and the ram are designed to withstand the heaviest and severest load without deflection. The internal ribs are divided and when the ram is adjusted in the extreme forward position complete rigidity is assured. The tool head swivels to 190 degrees and is locked at the top to the ram by one screw.

The rocker arm is a very important mechanism in the shaper, inasmuch as it actuates the ram. The specifications are of Whiteworth design, giving approximately 2½ to 1 quick return. With this design, tool chatter is eliminated and perfect balance at high speed with a minimum of shock is assured.

For further details and descriptive literature address Sales Service & Mfg. Co., 475 N. Cleveland St., St. Paul, Minn.



How Small Quantity Runs can be held without fixtures

Where runs are too small to warrant making jigs and fixtures, today's production demands are for Knu-Vise Toggle Clamps and Quick-Action Pliers.

Illustrated here is a case where production was carried on without loss of time; no necessity to wait for fixtures. The two large C-Clamps served as temporary fixtures while the large throated pliers held the work in place during drilling operations.

C-Clamps are available in 5", 6", and 10" sizes, and lend themselves to a range of 15 to 20 different setups. The pliers have 3", 4", and 6" throats.

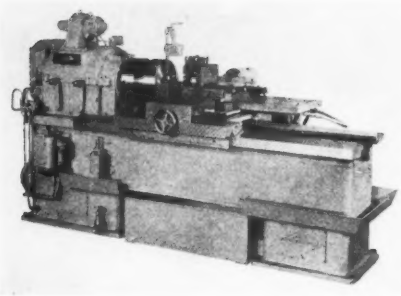
Let us help you with your clamping problems

KNU-VISE INCORPORATED

1332 PLUM STREET DETROIT, MICH.

4328 San Fernando Rd., Glendale, Calif.

New Norwood Hydromatic Lathe
Cuts and Finishes Shell Bases



ALL movements of the New Norwood Hydromatic Lathe are completely hydraulic and operations are automatic. Any operator of ordinary intelligence can operate the lathe and turn out a maximum in production for there are only two simple operations—both controlled by levers or push buttons.

This new lathe is being manufactured in four standard models for the different operations in turning shell from 50 mm to 155 mm. The model illustrated (ST-5) is for cutting off and finishing the base of the shell and for cutting the band groove. This model has a carriage in a fixed position on which is mounted a cross slide with one tool holder and a back bracket on which is mounted a back tool slide with two tool holders. The operator has two duties to perform—chucking the shell and starting the automatic cycle. All tool movements are automatic.

The hydraulic system permits the maximum cutting speed the work and tools can stand. It affords uniform feeds with infinite variations as well as complete freedom from chatter and vibration.

Write The Norwood Engineering Co., 106 N. Maple St., Florence, Mass., for further information.

Sharp Tools Wear Longer... Do a Better Job

SAVE YOURS with

QUEEN CITY GRINDERS

BALL BEARING BENCH, PEDESTAL and DISC TYPES

Tool grinding is only one of the many jobs handled efficiently by Queen City Grinders.

They are built in a complete range of sizes in bench, pedestal and heavy duty box type bases in units from 1 H.P. to 10 H.P.

These grinders are powerful—sturdy units equipped with two Carborundum wheels, one coarse, one fine—safe enclosed wheel guards with built in exhaust—Allen Bradley push button switch with overload protection—adjustable and safe work rests—tool tray—water pot—adjustable, shatter proof, clear glass eyeshields.

All Queen City Grinders come fully equipped with grinding wheels, ready for immediate use.

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Indianapolis Machinery & Supply Co.	Indianapolis, Ind.
James W. George Machinery Co.	Detroit, Mich.
Eichman Machinery Co.	Kansas City, Mo.
McDonald Machinery Co.	St. Louis, Mo.
Cincinnati Machinery & Supply Co.	Cincinnati, O.
Hess-Schenck Co.	Cleveland, O.
E. W. Smith Machinery Co.	Columbus, O.
C. H. Gosiger Machinery Co.	Dayton, O.
Elyria Belting & Machinery Co.	Elyria, O.
State Machine Tool Co.	Milwaukee, Wis.

QUEEN CITY MACHINE TOOL CO.

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Spiral Milling Possible on Vertical Universal

THIS is a versatile tool room and production machine able to perform several varied operations such as boring, milling and drilling without changing the setup. In that the milling head will turn to any angle, the machine is also capable of spiral milling.

The upper part of the column contains a large bore for the reception of a swivel drum. Attached to the swivel drum is a worm wheel of large diameter, meshing with a worm mounted on ball bearings inside the column. The swivel is securely clamped when in any position by a large diameter flange acting as a brake. A locking drum fits over the flange and is locked with a single nut. To change angular direction of the spindle a locking nut is loosened and the head swung into a new position. This is accomplished by turning the worm handle fitted with a dial showing one turn as 5°.

Electrical controls for three motors are all located in one large box. Push button switches control all motors. The feed motor will not start with the spindle idle and will stop when the spindle is stopped.

Power feeds and rapid traverse are provided with all directions controlled. A one horse power motor supplies the power for these feeds. The rate of feed can be varied by the turn of a hand wheel with rate shown by a dial behind it.

Shields Mfg. Co., Inc., 38-13 24 St., Long Island City, N. Y., will send more data.

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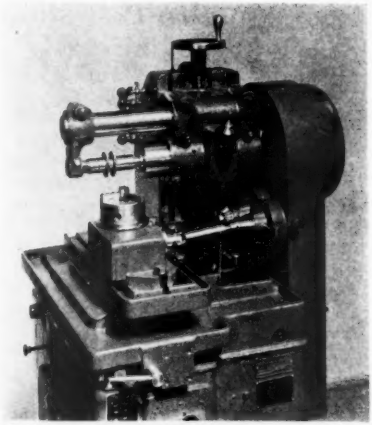
5418 Lakeside Avenue CLEVELAND, OHIO Phone Henderson 9100

Extreme Accuracy on Intricate Cuts

U. S. MULTI-MILLERS are designed for milling operations on small parts requiring extreme accuracy and intricate cuts. They have proved especially valuable to the manufacturers of small arms and aircraft products.

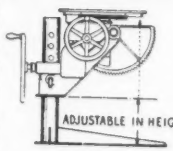


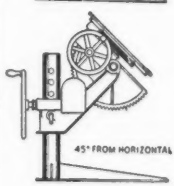
The Multi-Miller illustrated is equipped with an automatic indexing fixture and cutter for straddle milling a hex on an aircraft part. The guards have been removed to show the drive of the fixture from the table cam shaft. A positive table return is used with this type of fixture since part of the indexing is performed during the return stroke of the table. Three indexes of the fixture are required. After the machine is started, the operation is automatic and will continue indexing for three cycles of the machine necessary to produce one part.

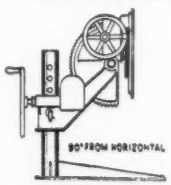
These automatic index fixtures are available in both vertical and horizontal types and can be furnished for any desired number of indexes. A single operator can handle a number of machines as his only job is to load and unload the fixture.

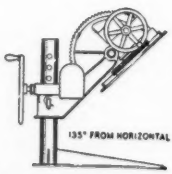
Wherever light and medium sized parts are milled, either in large quantities or small, the Multi-Millers offer the advantages of extreme accuracy and low cost production—with a low machine investment and a short set-up time.

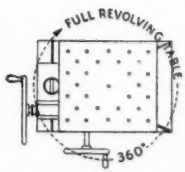
U. S. Tool Co., Inc., Dept. 8, Ampere (E. Orange), N. J., will send Bulletin No. 60 on request.











AFTER a welding assembly is once fastened to the table of a C-F Welding Positioner, the welder, without any other help, can tilt the work to any angle from horizontal to 135° beyond horizontal and he can turn it to any degree within a complete circle. This means better welds all "down hand," safer handling and faster production. Sizes from 1,200 to 14,000 lbs. capacity are described in our booklet WP 22. Write for your copy. It tells the complete story.

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Designed for Extra Accuracy on Small Parts

THIS machine has been primarily designed for precision work and is easily set up for spiral gears and other helical forms. It fills the demand for extra accuracy required on many small parts, twelve diametral pitch and finer. Accuracy of not more than .0006" accumulative error between nonadjacent teeth and .0003" between adjacent teeth on a 4" pitch circle is guaranteed.

The Precision Hobbing Machine is fundamentally the same as the Standard No. 3 but selected parts are used and extra care applied in making all fits. For example, an extra large single thread worm gear in the index drive for the work spindle increases the machine ratio. Also, the feed drive is through a spur gear transmission to a worm and worm gear on the feed screw. This feed screw is held to close limits of accuracy. Extra care is taken in scraping the slides as well as the fitting of spindle bearings.

The coolant reservoir is cast integrally with the sub-base. The coolant flows slowly over dams and through compartments in the reservoir to remove heat and settle out small chips and other sediment. A belt driven centrifugal pump delivers the coolant to the cutting area through an adjustable, valve controlled flat nozzle.

Bulletin No. FJ-1408 contains full details. Write Barber-Colman Co., Rockford, Ill.

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The Ultra-Lap machine will finish your parts to a flatness of one light band or less . . . to a smoothness as low as one micro-inch R.M.S., any metal or material. Much faster, more uniform than hand method. Machine designed for you or we shall be pleased to lap your parts on a job basis. Ultra-Lap machines and service used by aircraft and many other war-time industries.
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WELDING RODS
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Full particulars on request

DARWIN & MILNER, Inc.

1260-64 W. 4th St. Cleveland, O.

Modern Milling Fixture Design

(Continued from Page 46)

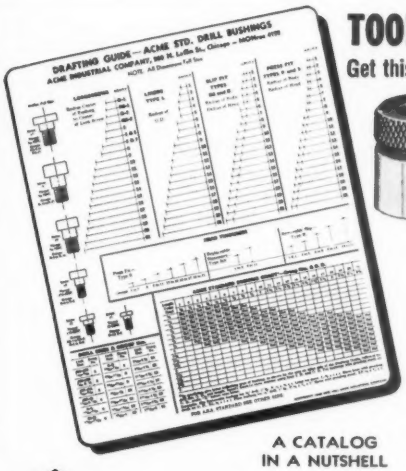
teeth. These cutters are sometimes used in pairs for cutting wide slots in which an accurate width must be maintained, but where the bottom finish is unimportant. When sharpening the teeth, a 4° clearance angle is used on the diameter teeth and a 3° clearance angle on the side teeth. Half-side cutters can be obtained in standard sizes up to 8" in diameter and 1" width of face. Hole sizes are 1¼" and 1½" in diameter and key-ways are provided in the holes.

Speeds and Feeds

For speeds of cutters the circumferential travel of the cutting teeth in feet per minute must be found. If this is represented by C and the extreme outside diameter of the cutter by D then: $C = D \times \text{rpm} \times 0.262$. However, cutter speeds vary widely because of the hardness of the work material and its inherent abrasive action. Sand in castings and sulphur in vulcanized rubber are typical examples of the need for slower speeds. Furthermore, milling cutter speeds depend very much upon the material from which the cutters are made —stellite, cemented carbide, high speed steel, or the common carbon steels.

Economical milling depends upon being able to run the cutters at highest speeds and at the same time using the greatest feed the work will take without too many stops for grinding the cutters. This too depends largely upon the depth of cut, the size of the milling machine and the efficiency of the milling fixture to hold the work rigidly. Obviously, these conditions and complications are so many that it is advisable to determine the speeds and feeds by trial for each mass production job. Make a record of the best run, including the machine used, and use this data the next time the same job is scheduled for production. There

(Continued on next Page)



A CATALOG IN A NUTSHELL

TOOL DESIGNERS . . .

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★Accurate (full size) drawings of drill jig bushings can be made *faster* when the Acme Drafting Guide is used. Dimensions are shown graphically and can be picked up directly from the guide with compass or divider . . . no cut-outs to give inaccurate tracings. Shows all necessary symbols and specifications for ordering. The Acme Drafting Guide is conveniently sized (8¼" x 10") printed in green and red to show the A.S.A. and Acme Standards respectively. Write for a copy of this valuable time-saver today . . . it's yours for the asking!

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are several good handbooks available in which the proper speeds and feeds are given for milling several materials.

(Drawings courtesy Illinois Tool Works)

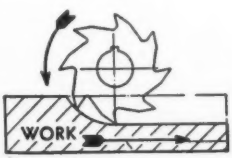
Correction

In the July issue, the two line drawings, Fig. 32, page 51, were reversed. We reproduce these drawings with the correct caption.

Our apologies to Mr. C. W. Hinman, the author of this article, and to our many readers who called this oversight to our attention.

New Delta Booklet

Many time-saving adaptations of low-cost machines to all branches of the armament program are photographically shown and described in an unusual new booklet just published by Delta Mfg. Company, 612-H E. Vienna Ave., Milwaukee, Wis. Scores of actual shop photographs show the astonishing scope of the new type low-cost drill presses, grinders, cut-off machines, abrasive finishing machines, circular, scroll and band saws.



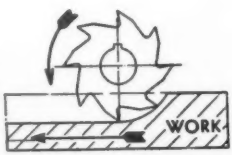


Fig. 32—The two methods for making milling cuts. The one on the left is called "climb milling," while on the right, conventional milling is shown.

Production moves faster

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Fig. 1434

KNURLED SOCKET HEAD CAP SCREWS

The knurls keep the mechanic's fingers from slipping in spite of oil and grease and therefore help him to save time before applying a wrench. They also make it possible to use pliers to make adjustments where the use of a wrench may not be convenient. Pliers on smooth heads slip too easily.

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Designed for speedy, accurate setting of boring tools and many other tool setting applications. Saves time, labor and costly errors.

A model with a dial indicator instead of micrometer is also available.

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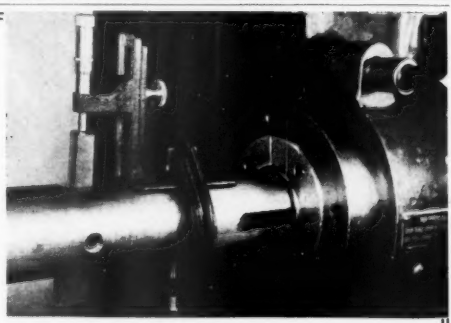

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USES: Setting cutting tools in boring bars—Milling machine set-up—Planer set-up—As a height gauge—As a depth gauge—Layout and inspection.

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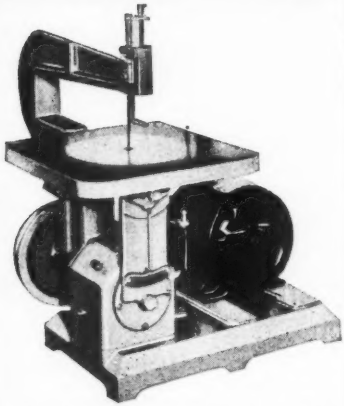
Atlas Die Filing Machines



Can be used for all kinds of die making. The overarm is constructed so that the file and saw attachments may be interchanged with little effort. The holddown fingers are attached directly to the overarm. Working surface of the table, which tilts two directions, is entirely clear. An improved type of chuck, consisting of movable hardened jaws, holds both saws and files. Screw adjustment makes changes easy and fast.

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Motor Drives
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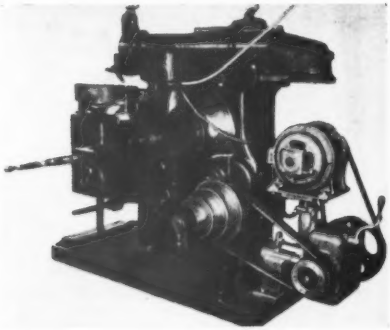

BERKELEY Motor Drives are designed and custom-built for every type and size machine tool.

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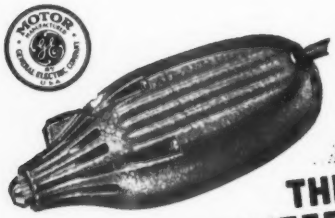

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DURO FOR DURABILITY

Gairing TOOLS

Counterbore Sets

Speed production with a kit of these efficient tools that eliminate costly delays in counterboring and spotfacing operations. Seven sets from which to choose. Each contains a logical selection of interchangeable counterbores, pilots, and holders. *Write for circular and prices.*

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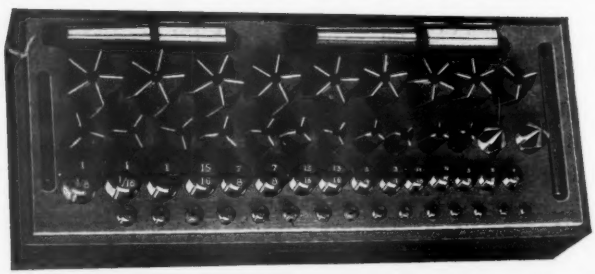
THE GAIRING TOOL CO., Detroit, Michigan



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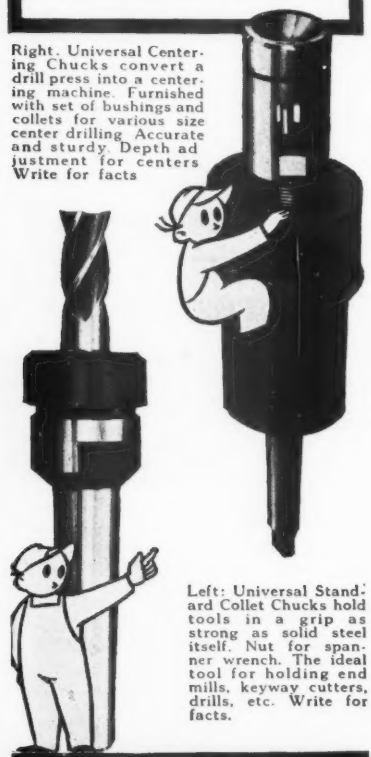
UNIVERSAL CENTERING CHUCKS AND STANDARD CHUCKS STEP UP ACCURACY —INCREASE SPEED



Right. Universal Centering Chucks convert a drill press into a centering machine. Furnished with set of bushings and collets for various size center drilling. Accurate and sturdy. Depth adjustment for centers. Write for facts.

Left: Universal Standard Collet Chucks hold tools in a grip as strong as solid steel itself. Nut for spanner wrench. The ideal tool for holding end mills, keyway cutters, drills, etc. Write for facts.

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Taps guided by precision leads.
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Precision tapping on a production basis. Class 3 and 4 specifications easily met. A high quality machine with 4 speeds 95 to 395 RPM and dial indicator for bottom tapping. Ball bearings throughout. Equipped with coolant pump system. No skilled operators necessary — sensitive touch — minimizes "rejects".

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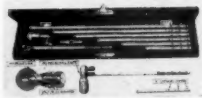

Available in 2 sets: 1½" —6" and 1½" —12" including case and handle. Accuracy unconditionally guaranteed. M & L POSITIVE OFFSET BORING HEAD 0-15". New "HANDY KNURLER", used like pair of pliers. BRAND TELESCOPE GAGES ½"—2⅛" capacity—are a few of the many tools available from the Brand Tool and Supply Company. Write for complete information—NOW!

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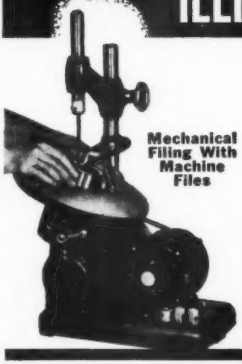
ILLINOIS DIE FILING MACHINE



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A versatile bench type machine for all three major production steps in the die-making process—sawing, filing and stoning. Quality built throughout to stand up longer and produce more accurate work. Forced-feed lubrication plus hardened and ground shafts running in bronze bushings combine to minimize wear and prolong life. Maintained accuracy is secured through holding chuck and clamping device which provide positive file alignment, and balanced moving parts which operate without vibration. *Write for descriptive literature.*

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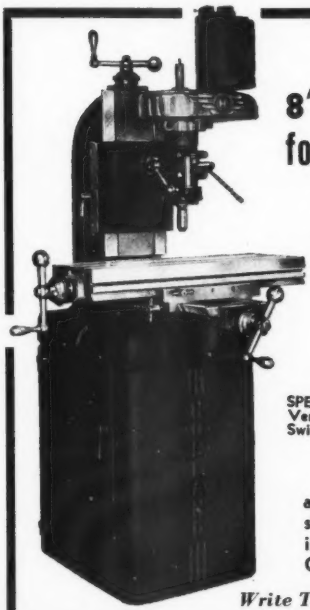

Holland

8" x 16" VERTICAL MILLER for AIRCRAFT PARTS PRODUCTION

THIS rugged miller is widely used in aircraft and armament plants, as well as toolrooms. The high-speed head, a self-contained motor-driven unit, can be turned to any angle parallel with the longitudinal feed. Compact design, with extra large handles and convenient controls, make the Holland Miller ideal for small parts such as the shackle shown below.

Chrome-plated quill has lever feed. Large feed dials for easy reading. Spindle mounted on precision pre-loaded ball bearings.

SPECIFICATIONS: Table Size, 8" x 26"; Table Range, 8" x 16"; Vertical Feeds, 3" on Quill, 8" on Quill Head; Collet Capacity, ½". Swivel Head graduated to 90° left and right. Dial Graduations in .001".

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Sales and Technical Literature

Send Request on Company Letterhead

A "BABY" GUSHER—for small machine tools is described and illustrated in a new eight-page folder available from The Ruthman Machinery Co., 1813 Reading Rd., Cincinnati, O. This product is the result of the growing demand for a small Gusher coolant pump for small machine tools. Complete instructions for ordering are contained in this folder, as well as prices and all specifications. Write the manufacturer for this folder today.

HOPP PLASTIC SERVICES—Hopp Press, Inc., has available a broadside which discusses their two modern services—printing on plastics and laminating of transparent plastics to printed matter. Also listed are their various departments for Defense sub-contracts and facilities to handle injection molding, extrusion molding and metal stamping.

WILSON PRESSES—Booklet WP amply describes and illustrates, by action photographs, the many man-saving features of the KRW presses, such as the convenient location of hydraulic pump handle, an easily operated one-man lifting device and a built-in mechanical arbor press. Complete specifications are included for each press. K. R. Wilson Co., 10 Lock St., Buffalo, N. Y., will send Booklet WP at your request.

LAFAYETTE ROTARY TABLE—The rotary table is a useful addition to any shop to do a variety of work on milling machines, shapers, drill presses and horizontal boring mills. Special Circular L, issued by the Lafayette Tool & Supply Co., 176 Lafayette St., New York, N. Y., profusely illustrates and describes their line of rotary tables, milling machine vises and magnetic chucks. Send for your copy.

SUPER SIGHT—is the subject of a four page catalog just released by The Boyer-Campbell Co., 6541 Antoine St., Detroit, Mich. It shows how this product combines magnification and properly directed light for close inspection, fine assembly and precision machining.

GRAND RAPIDS SURFACE GRINDERS—described in Bulletin GL-100, are the result of over 30 years actual experience in the building of high grade precision grinding equipment. The complete line is well illustrated and important construction features are discussed. Specifications are also included for each machine. Gallmeyer & Livingston, 304 Straight Ave., SW, Grand Rapids, Mich., will send a copy of this bulletin at your request.

PRECISION DRILLING MACHINES—Two distinct features of the Providence drilling machine—the use of high grade ball bearings at every rotating point and the over-size of spindle and spindle sleeve for sustained accuracy and long life—are discussed in Bulletin P. Illustration and descriptive captions facilitate feature-by-feature inspection. For bulletin and prices address Providence Engr. Wks., Inc., 521 S. Main St., Providence, R. I.

STURDIMATIC LIVE CENTER—A new four-page catalog giving complete information and specifications concerning standard Morse taper live centers has been released by Sturdimatic Tool Co., 5224 Third Ave., Detroit, Mich. With a background of twenty-five years of experience in tooling for metal working operations, this company also offers a complete engineering service for the design of special centers whenever required.

A NEW 16-PAGE BULLETIN gives a condensed listing of Wheelco Instruments Company's complete line of measuring and control instruments. It describes and illustrates unit construction of temperature controllers and explains the company's "electronic principle" for effecting control without contact between the measuring and control functions of the instrument. Remote controllers, combustion safeguard equipment and other instruments are also covered. Send requests for Bulletin No. 26000 to Wheelco Instruments Co., Harrison & Peoria Sts., Dept. T, Chicago, Ill.

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• Genuine Java Water Buffalo Hide replaceable faces in malleable head.

No.	Dia. in ins.	Wgt. in lbs.
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1	1¼	1⅛
2	1½	1⅜
3	1¾	2¼
4	2	4
5	2¾	5½

• A finely balanced Tool with tough, resilient Java Water Buffalo Rawhide heads.

Not Loaded				Loaded Mallets			
No.	Dia. Ins.	Lgt. Ins.	Wt. Ozs.	No.	Dia. Ins.	Lgt. Ins.	Wt. Ozs.
0	1	2⅛	2	7	1¼	3	8
1	1¼	3	3½	8	1½	3⅛	12
2	1½	3¼	6	9	1¾	3⅜	16
3	1¾	3¼	7½	10	2	3½	20
4	2	3½	10	11	2¾	4¼	42
5	2¾	4¼	21				
6	2¾	4¾	23				

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Shoulder slung operation illustrated

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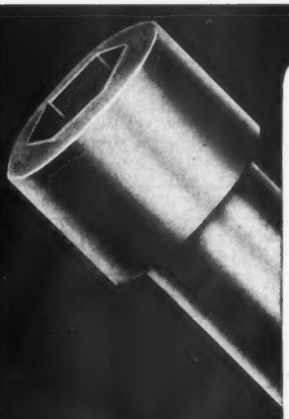

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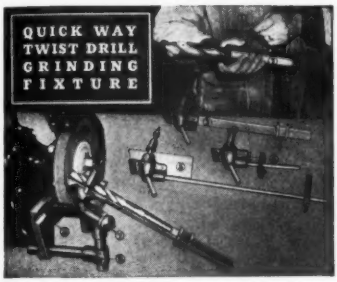

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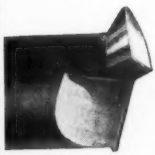

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For speed, economy, accuracy, and efficiency use Bokum Boring, and Internal Threading Precision Tools.

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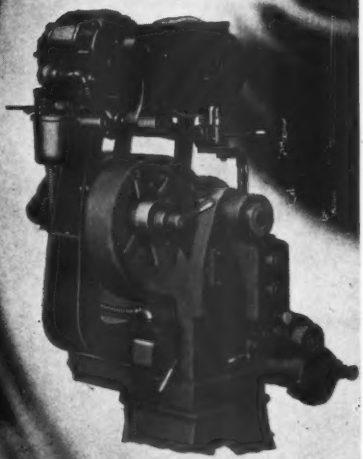

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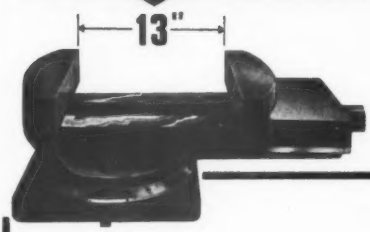

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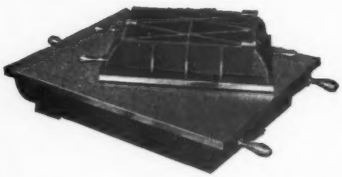

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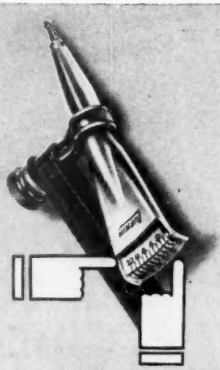

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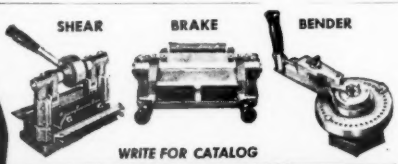

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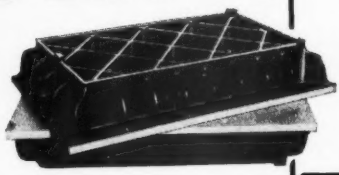

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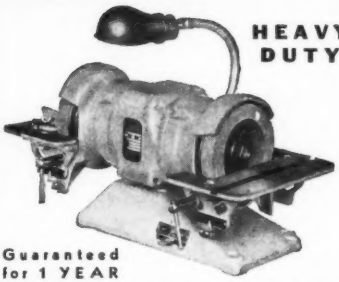

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(Continued from Page 49)

could be reduced to a recipe, a typical case would go something like this:

1. Chuck the part in a lathe and give it a truing cut.
2. Undercut, groove and roughen the surface with a roughening tool, or by sandblasting, to provide a key for the coating to the base metal.
3. Clean the surface free from grease, oil, water or oxide films to assure intimate contact.
4. Spray on the coating to a finishing allowance, filling the low areas first.
5. Grind the part to finished size.

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Savage Tool Company, Dept. TD, Savage, Minn.

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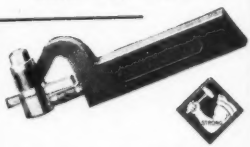

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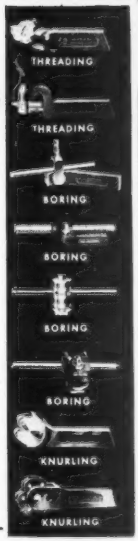

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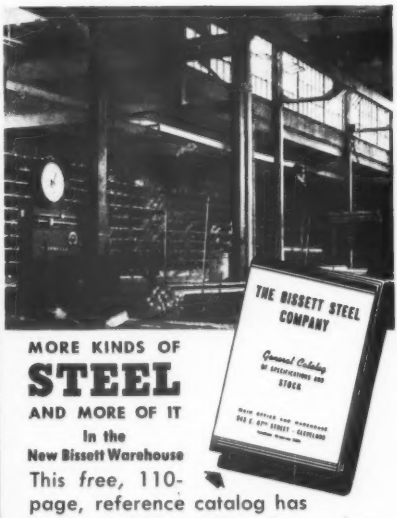

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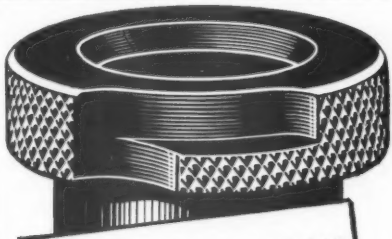

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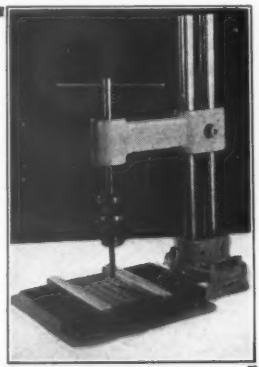

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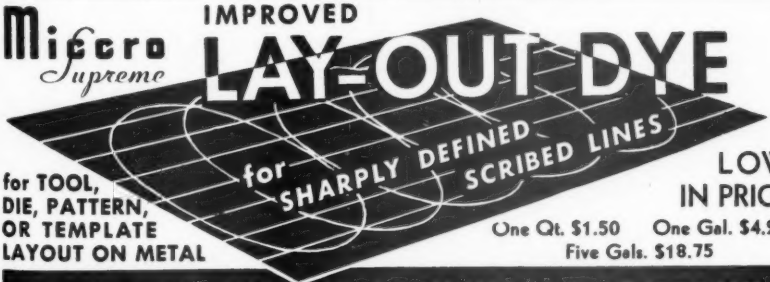

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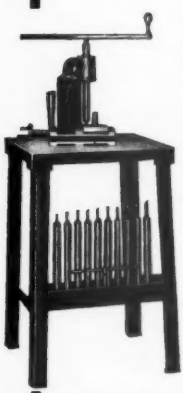

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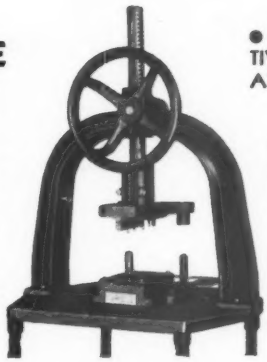

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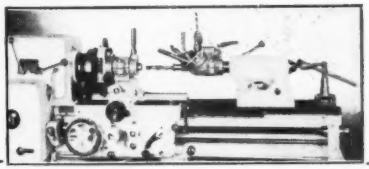

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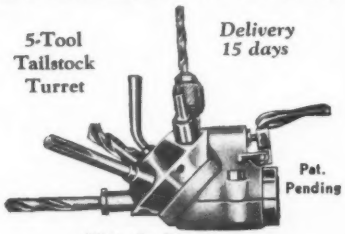

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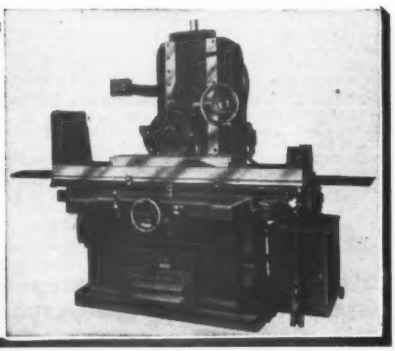

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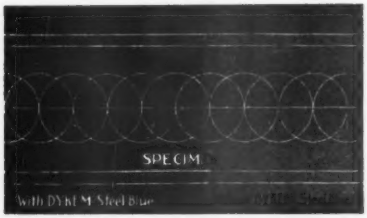

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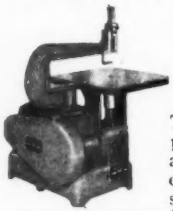

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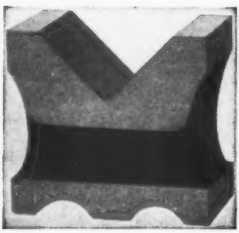

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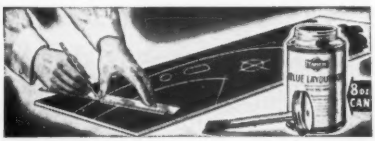

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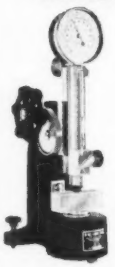

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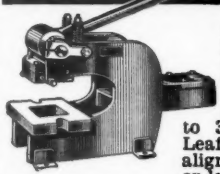

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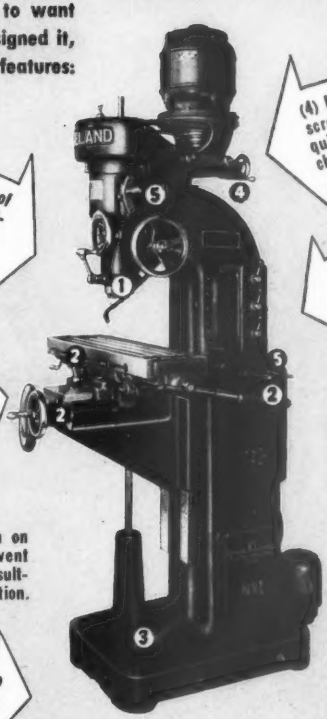

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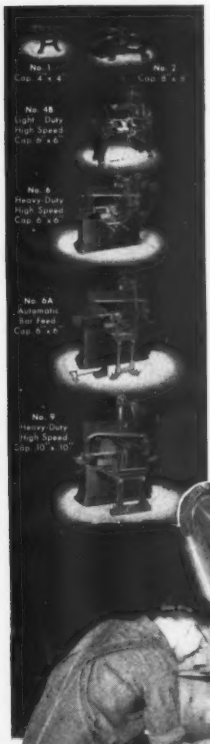

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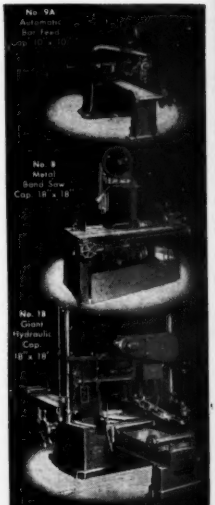

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